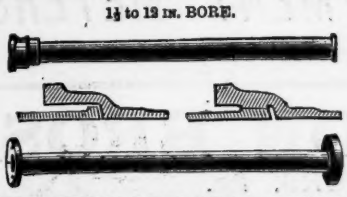
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1808.] LONDON, JANUARY 4, 1898. [50TH YEAR. PRICE 6d.

GAS AND WATER PIPES
1¼ to 12 IN. BORE.



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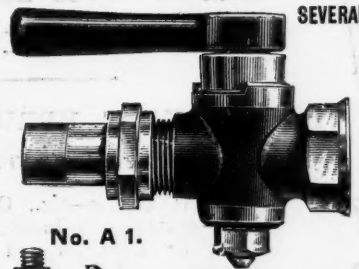
SEVERAL DESIGNS SHOWN BELOW.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THESE TAPS ARE
FULL-WAY
AS SHOWN.
SUPERIOR QUALITY AND FINISH IN GUN METAL.

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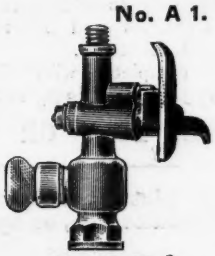
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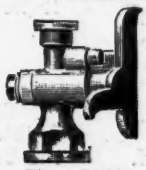
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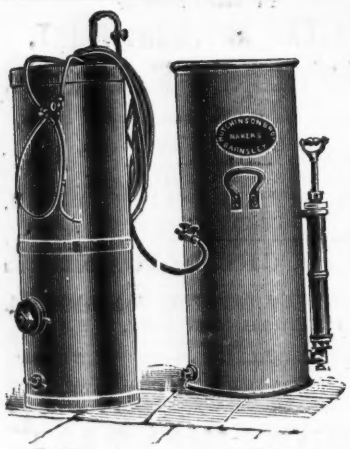

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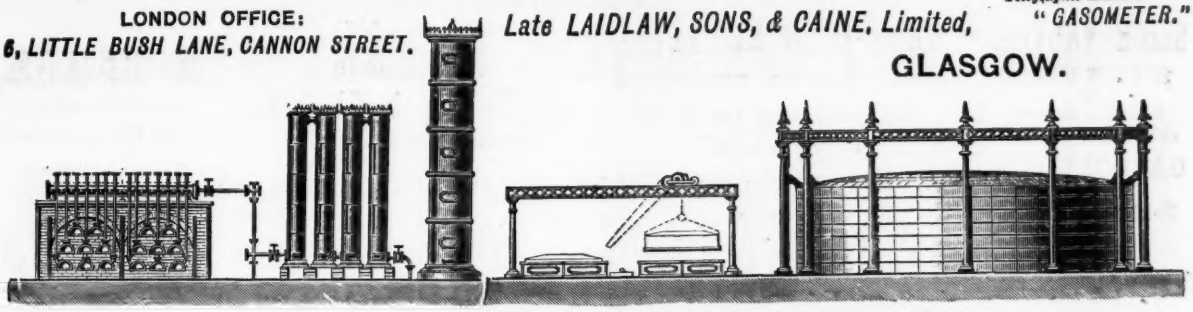

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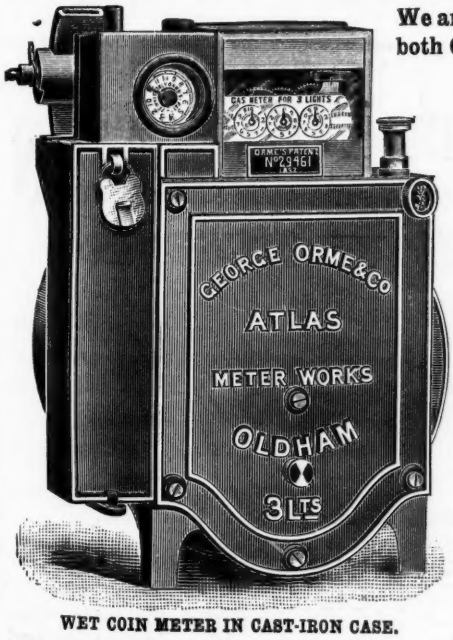

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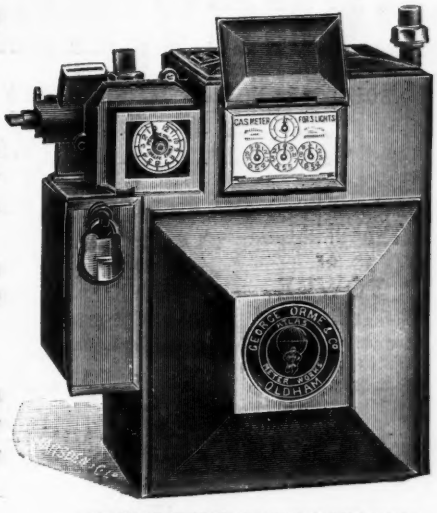

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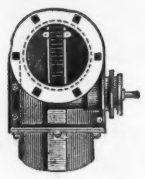

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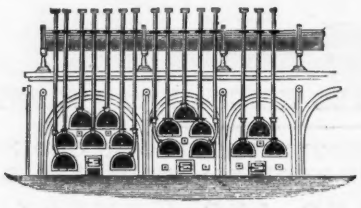

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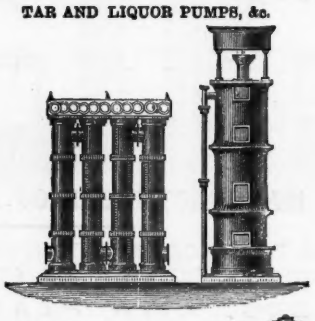

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CENTRE-VALVES
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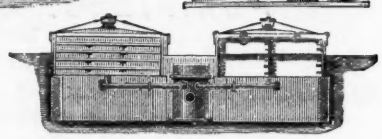

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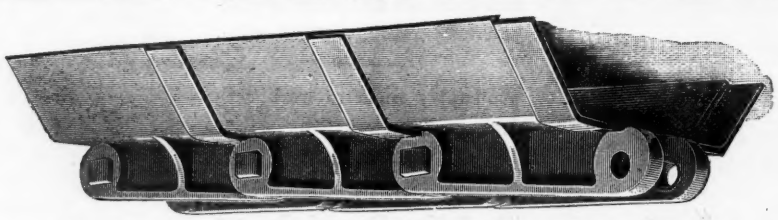

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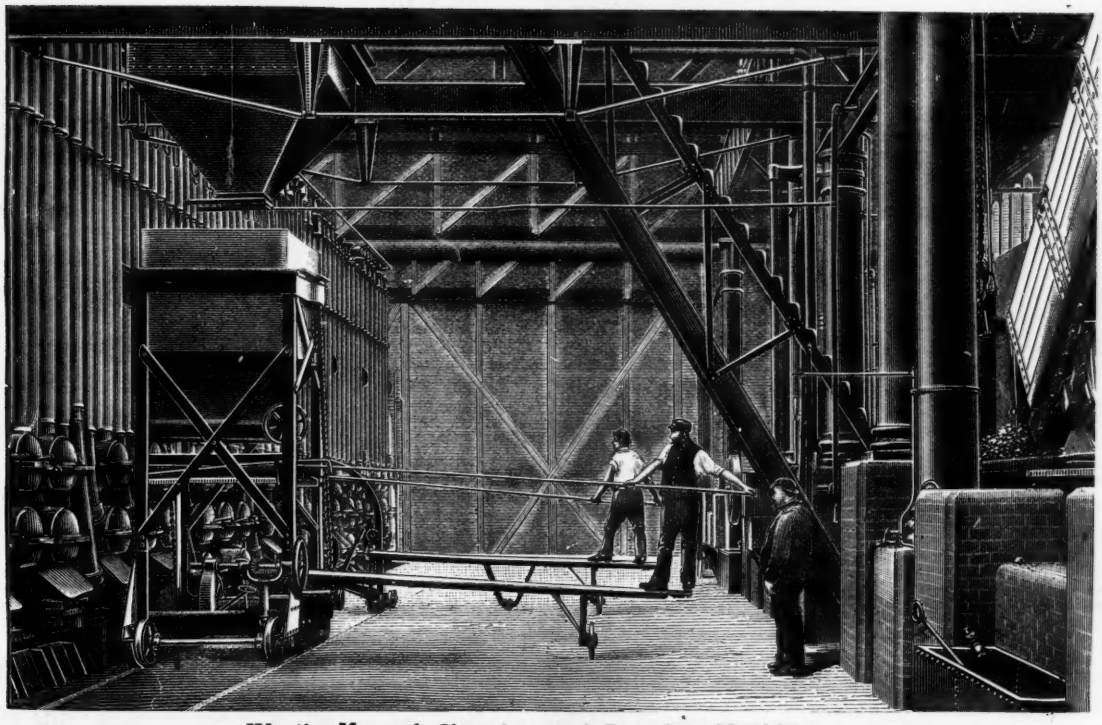
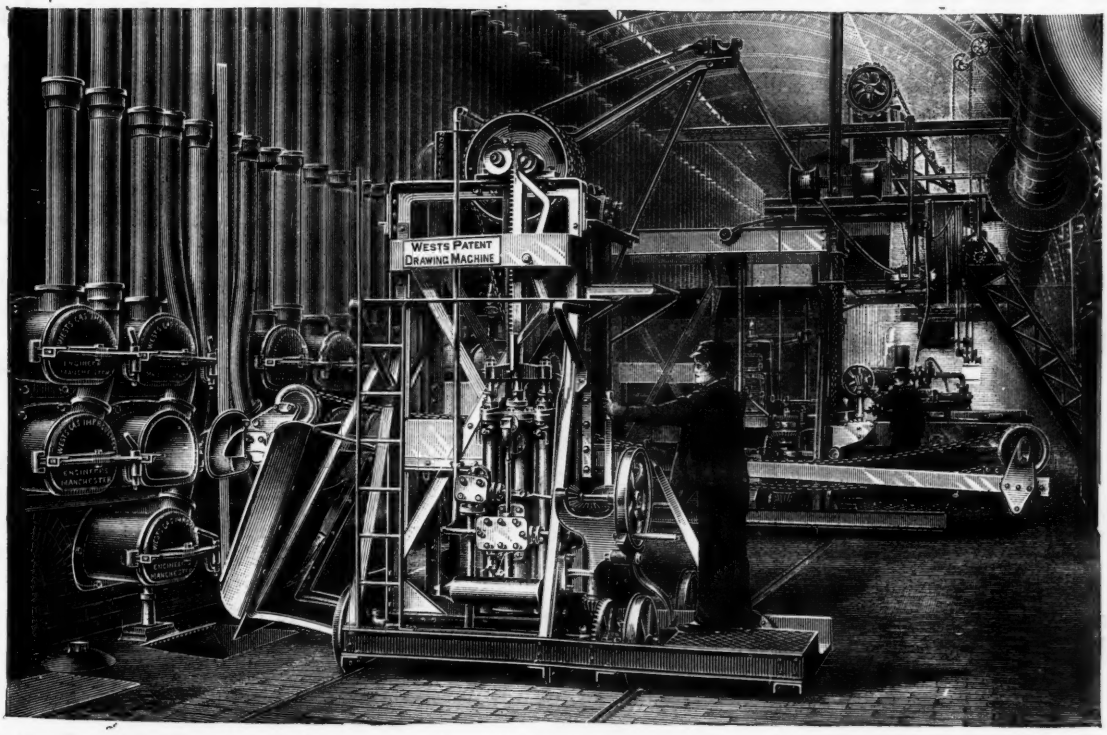


West's Manual Charging and Drawing Machines.



West's Compressed-Air Drawing and Charging Machines.

Contractors for

WEST'S REGENERATOR SETTINGS & RETORT-HOUSE PLANT.

IMPROVEMENTS IN STREET LIGHTING.

Highest Efficiency with Greatest Economy.

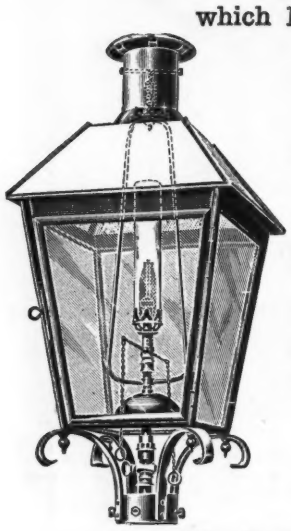
LIGHTING AUTHORITIES, GAS ENGINEERS, and GAS MANAGERS

are invited to inspect the

INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of



STREET LIGHTING,

the difficulties caused by VIBRATION having been OVERCOME by the use of the

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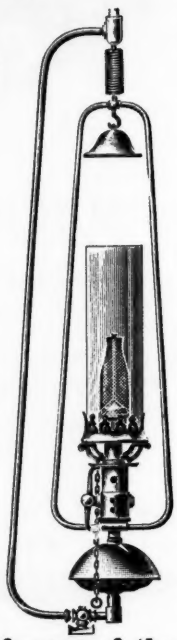
This System of Lighting meets the requirements of all Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting WITHOUT INCREASE OF EXPENDITURE.



The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

"In the matter of maintenance of the street lights, the record is favourable—in fact, more so than the estimate provided. By the test-meter, the average daily consumption works out to 38 cubic feet per light, including bye-pass. The bye-pass consumes with a flame half an inch long, $\frac{1}{6}$ foot per hour. This represents 1000 cubic feet per lamp per annum. The average consumption per light, when in use, works out to 12,900 feet per annum, or about $3\frac{3}{5}$ feet per light per hour. The lighting is continued all the year round, from the average times of one hour after sunset to one hour before sunrise."

"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

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"The number of lights attended to per man averages 85."

"The 'Welsbach' Light is undoubtedly one of the greatest aids to successful competition that the Gas Industry has ever experienced. Its influence, while reducing the relative cost of light, has advanced the consumption of gas all over the country by the increased satisfaction of the existing consumers, and the attraction of others. The writer feels that its influence should not be confined to the house. It is capable of meeting every competitor in the street, from cheap oils to arc lights, in cost and in effect; and it is hoped that the foregoing experience may lead many others to seek its aid and to realize its efficiency."

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WE GUARANTEE RESULTS.

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We desire to call attention to our SHALLOW REGENERATIVE SETTINGS, which are comparatively inexpensive to erect, and productive of excellent results. They are specially designed to suit those Retort Houses where for various reasons it is undesirable to excavate to any great depth.

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PREPAYMENT GAS-METER

FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
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4. Unaffected by irregularities in shape or thickness of the penny.
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8. Index showing number of Pennies in the mechanism at any time.
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GUARANTEED FOR FIVE YEARS.

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OIL FOR GAS MAKING

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HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

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FLASH POINT GUARANTEED OVER 200° FAHR.

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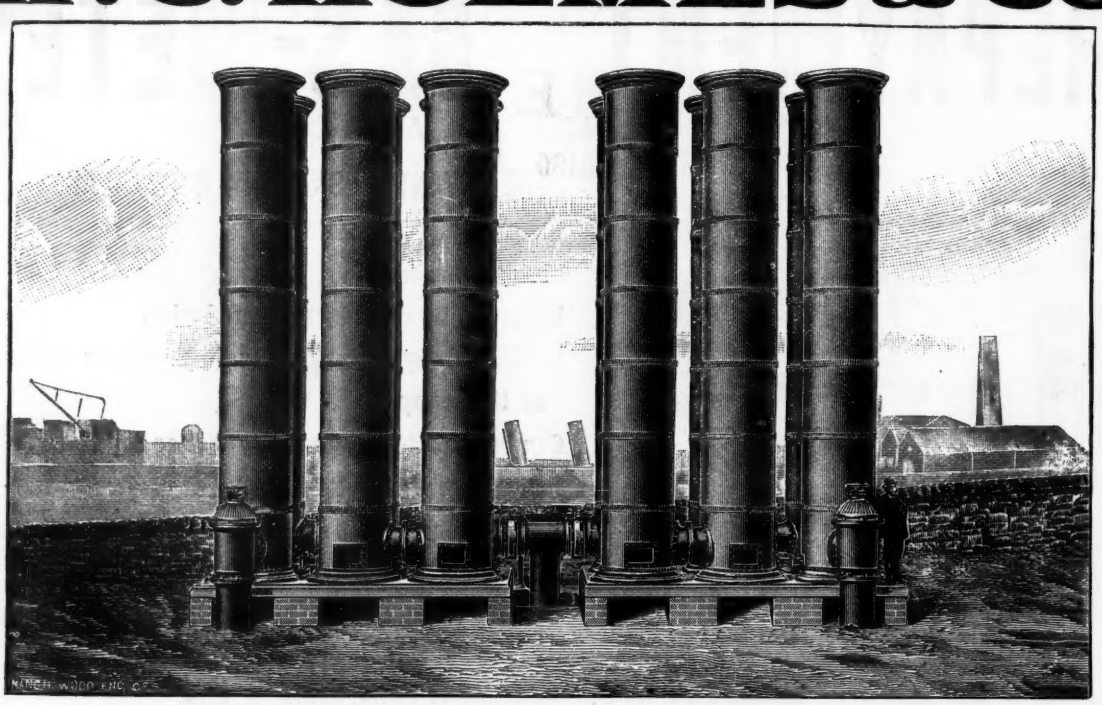

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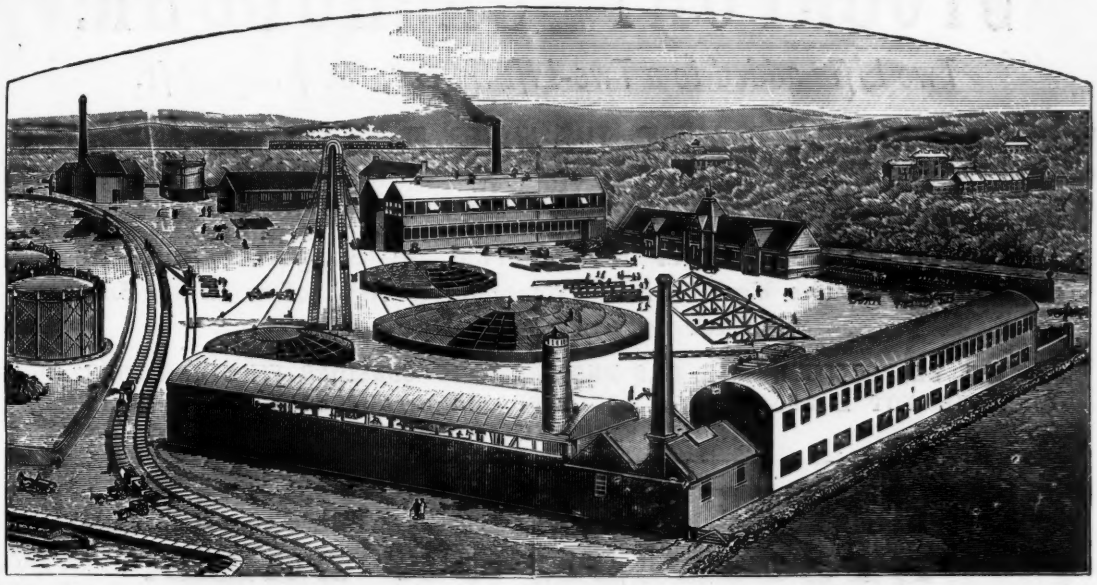

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SPECIAL BRICKS and BLOCKS of every description for GENERATOR and REGENERATOR FURNACES.

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WITHOUT REMOVING THE WATER FROM THE TANK.

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The Crown Trussing is now carried on Supports; and the Pressure of the Four Lifts is practically that of a Three-Lift Holder with a Trussed Crown.

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EXHAUSTERS,
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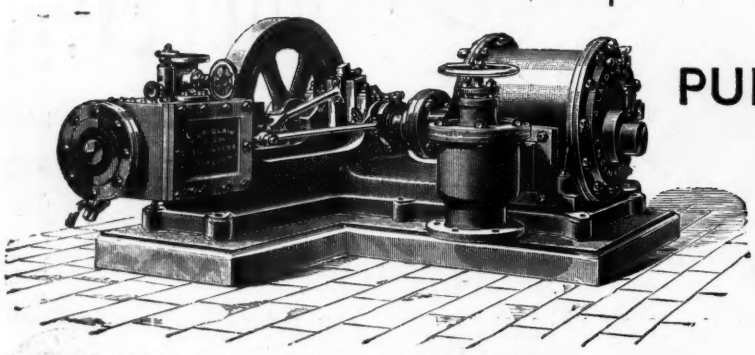

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ALL KINDS OF
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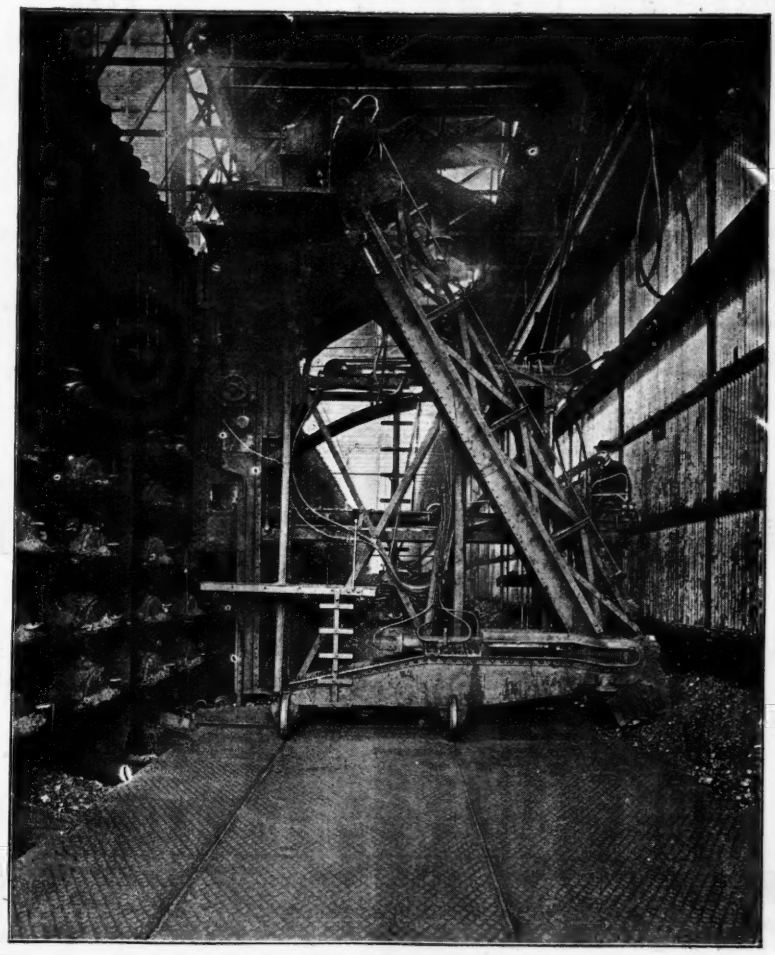

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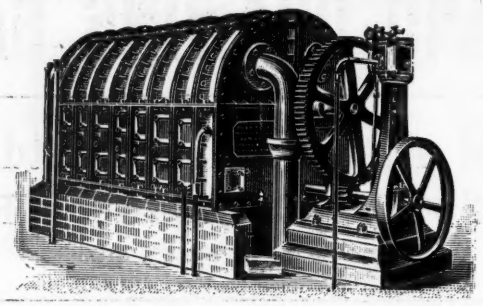

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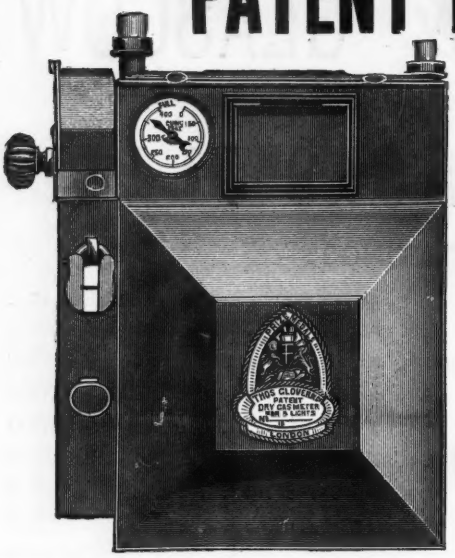

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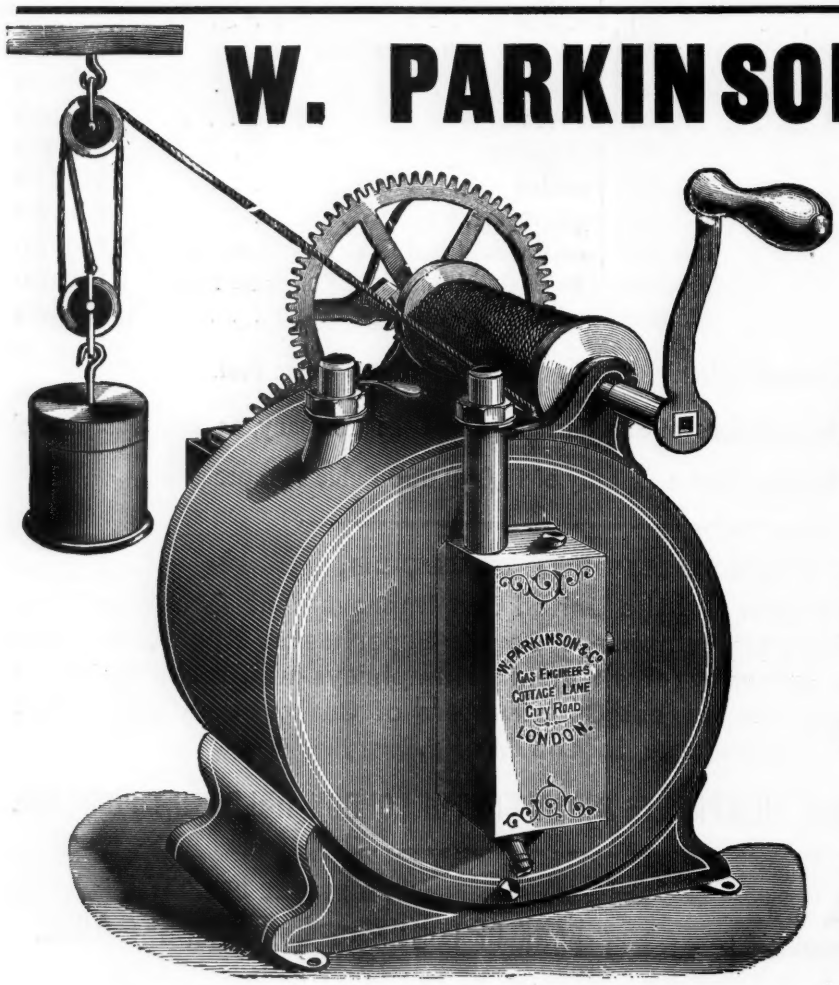

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EDITORIAL NOTES.

The Strike in the Engineering Trade.

IT is hard to say whether the state of affairs in regard to the trouble of the engineering trade is bad or good. When we last mentioned the subject, the Trade Union delegates to the conference between the parties had notified their intention of taking a ballot of their supporters upon the question of accepting or rejecting the terms of settlement offered by the federated masters. We then remarked that the result of this proceeding would be governed by the manner in which the issue was put to the men; and the event has justified this opinion. It has also shown how farcical this kind of *referendum* is in practice. When the adjourned conference broke up, it had produced and placed upon record a certain statement of the conditions under which the employers were willing that their work should be carried on in the future. This statement was the second of the kind, and was considered by the Trade Union leaders reasonable and satisfactory. They professed their willingness to accept these conditions of employment; and they would have declared the strike ended there and then, if only the masters had been willing to yield a point in the matter of working time. This, however, they would not do. They reminded the men's delegates that there was no question as to the duration of the working week before the conference took place; their original declaration that no alteration of time could possibly be entertained still holding good. Thereupon the Trade Union officials proceeded to ballot their society members. But, as usual, the issue was not put straight to the vote as the conference left it. The men were asked if they would return to work on the basis of a 51-hour week, as well as under the conditions of employment provisionally accepted on their behalf. Upon intelligence of this proceeding becoming known to the Employers' Committee, they communicated with the head officials of the A.S.E., pointing out the misleading character of the terms of reference, and repeating the statement that "no reductions of hours can be made, and that, before "any settlement can take place, the present demand "must be dropped." To this correction the officials returned a reply asking the writers of the letter to mind their own business. Meanwhile, the Trade Union officials were busy in arranging for a conference among themselves to gain support for their substituted demand for a 51-hour week; and the London Trades Council started drumming up all the Trade Unions of the country to procure additional help for the A.S.E.

It quickly appeared that the second ballot was going to result like the first, in rejecting the terms of settlement by an overwhelming majority. Having regard to the manner in which the voting-papers were drawn up, this result had no meaning other than a notification that the negotiations between the employers and the men were off. Of course, the action of the men was hailed by the Secretary of the A.S.E., in one of those daily "interviews" with which he gratifies an obliging Press, as exhibiting a "magnificent "spirit." Such phrases are cheap payment for all that the men are suffering at the dictation of the Trade Union officials. It transpired that the conference convened to secure further support for the A.S.E. proved abortive. The final result of the ballot was communicated in due course to the Employers' Committee, and thereupon it was notified that the "truce" was at an end, and that the further lock-out notices which had been held in abeyance would be posted and made operative forthwith. Rumours were set on foot to the effect that it was the intention of some of the Federated Employers to throw open their shops after the holidays to such of the men as chose to go to work under the terms of settlement without alteration of hours; but this action will not be countenanced by the Federation, which is firmly set upon making a clean finish to the campaign. It is very generally felt that holding the conference while the parties were all so deeply committed to their respective and contrary causes was a mistake. It delayed the final settlement, if anything; and its sole fruit was the declaration of the terms on which the Federated Employers mean to carry on their business. This was a gain, but not to the cause of immediate peace.

It is not to be thought that the end can be so very far off, as Mr. Barnes, with all his talk of the "magnificent spirit" of the men and the financial resources of the A.S.E., would fain have his Press friends believe. The funds must be

running very low; and the Barnes and Sellicks combination received a severe check in the failure of their endeavour to interest the other cognate Trade Societies in their quarrel. The strike will drag on a few weeks longer; but the circumstance that Mr. Barnes talks of getting somebody to raise the subject when Parliament meets, in the form of an amendment to the Address, shows that his case is wearing very thin indeed.

Meanwhile, the Federated Employers are as united as ever, and are even stronger than before. They held a meeting in York on Thursday last, at which a resolution approving of all that was done by their representatives at the conference was unanimously adopted. Morally, their cause has been strengthened by an expression of opinion by the Duke of Argyll, who writes: "As far as I can see, "the demand made by the employers as to the exclusive "control of the management of their enterprises is an "absolutely just demand and necessary; and if the refusal "of the employed does really turn on this, they are fighting against nature and against justice. Braincraft is the "governing power in all industrial enterprises; and all "attempts to make it subject to handicraft (which falsely "monopolizes the title of 'labour') must end in discomfiture and disaster to all concerned." The impression is deepening that, if the strike only lasts long enough, the "occupation" of the stubborn members of the A.S.E., like Othello's, will be "gone;" for all the engineering works will be running with free labour.

A Foggy Season.

The present season has so far been one of considerable anxiety with many gas managers throughout the United Kingdom. There has been little cold weather, but much fog; and the latter atmospheric condition has been of many consecutive days' duration in the most densely populated centres in the kingdom. London was visited during the Christmas week with a very troublesome fog, which, though not of extraordinary or uniform density, caused an infinity of trouble and heavy loss by interrupting railway and river traffic. At the same time, Glasgow, Newcastle-on-Tyne, and some other places, were equally afflicted. Of course, the London fog has produced the usual statistician, with his figures showing how much extra gas was burnt and what the fog cost per day for this and other means of artificial lighting. There is not much comfort, and very little utility, to be derived from statistics of this nature. Their publication without proper explanation in the newspapers is, indeed, rather to be deprecated, for the reason that they lead the ignorant to conceive that a visitation of fog must perforce be a good thing for the Gas Companies. It is not to be expected that the ordinary newspaper reader should know that the necessity of being prepared for a week of fog at the very busiest period of the year—as happened this Christmas—is one of the costliest and most troublesome of the burdens that Gas Companies have to bear. It is better to lay stress upon the fact, which seems to be established, that the historical "London particular" fog is not so black as it used to be. This amelioration, which it is hoped with reason will prove progressive, is ascribable to numerous causes; but unquestionably the chief of these is the extended use of gas by both rich and poor. The former are taking much more kindly to gas-fires and gas cooking every year; and the prepayment meter is quietly working a revolution in the domestic arrangements of the latter, which has a most beneficent corresponding effect upon the atmosphere of the most densely populated town districts.

A Curious Essay on Lighting.

In the last two numbers of the "Journal" we have reproduced a long and pretentious essay by Dr. W. H. Birchmore, originally prepared for the "American Gas-light Journal." It purports to teach the principles of "the illumination of enclosed space;" but we do not wish to be held responsible for the character of this teaching, or to be regarded as putting the essay forward as a helpful contribution to the solution of the problems of artificial lighting. We do not know who Dr. Birchmore is; but it is clear that he does not know much about the history and practice of artificial lighting; while his English is lamentably inadequate to express the little that he does know. It was observed recently in an American periodical that the usefulness of the multitudinous universities and colleges established in the United States is being much endangered by the growing neglect of the teaching of sound English in the preparatory schools from which the students proceed to these institutions, owing to which it is difficult for the students to express themselves clearly and concisely in writing. This essay is an example of the evil complained of. The writer is so wordy, so careless withal in the selection of words and their arrangement in the sentence, that it is tiresome to try to find out what he wants to say. It is impossible to accept his description of the old ways of lighting interiors, before gas was introduced. It is grotesque all through. Take the passage in which he avers that "lamps rather "than gas were the fashion in libraries in large houses in "London so late as 1856, and candles have never been "displaced in thousands of elegant bed-chambers in the "West-end, if one may judge from the written words." What sort of grasp of the subject does such a sentence imply? Considerations of historical knowledge and literary composition apart, however, we cannot credit Dr. Birchmore with having added to the previously existing store of knowledge of the subject. As a curiosity, his essay will repay perusal; but it badly needed translating into plain English, and cutting down to one-fourth of its bulk.

Sir R. Giffen on the Trade of the World.

Speaking at Stoke the other day, Sir Robert Giffen said some wise and timely words on the world's conflict of Free Trade against Protection. It is a peculiarity of this warfare that, whereas there is only one Free Trade, the principles and methods of which are susceptible of simple statement, there is no end to the shapes assumed, and the sanctions claimed, by Protection. Sir R. Giffen showed that while Protection pretends to score many victories, all the substantial successes are on the side of Free Trade. He argued that the extent of free trading in the world is so preponderating that, even where Protection rules, the mischief resulting therefrom is vastly mitigated. Moreover, the greater part of the world is now formed into large states; and in all these, whatever their external relations, internal trade is free. The speaker justly pointed out that the protectionist countries, even as regards their foreign tariffs, are far from giving much protection. High customs tariffs usually go with Protection; but they are not protective unless there is something internal to protect. This is far from being the case. We can supply an example in point, in the treatment of petroleum by the European protectionist countries like France and Germany. There is no domestic petroleum production in either of these countries; but foreign mineral oils are so taxed that the population have to pay dearly for artificial light. The Protectionist is the obscurantist, the reactionary. "The "true enemy of a protectionist policy is the man of science. "The man of science makes it possible to bring a particular commodity to Europe at a half or a third of the "cost at which it could formerly be brought. When Free "Trade is quite free, Europe is so much the richer." In the same measure as the nations of Europe become manufacturing producers, they must discover the need they have of cheap and abundant supplies of food and raw materials. It was this discovery that made England a Free Trade country, and all others must take the same course in their turn. What is Sir R. Giffen's conclusion of the whole matter? That business men, whatever their speciality may be, must give up the idea that there is anything to hope for in Protection, and accept the truth that "no industry can live anywhere which is not able to "face the most unrestricted competition. A better living "can now be made by everyone who is willing to work "than could have been made at any previous time of the "world's history. But work there must be in the bracing "and tonic air of competition; no reposing in quiet "corners with comfortable monopolies or under the protection of a paternal government which takes care of "people who do not care for themselves."

The British System of Appellate Judicature.

The exhibition of the weakness of the British judicature system made in connection with the notorious case of *Allen v. Flood*, has naturally evoked suggestions for reform. The scandal of the judgment was not in the condition of the law, but in the way of ascertaining beyond possibility of further dispute what the law really was. A writer in "The Times" put it: "After a lapse of two years and "eight months from the judgment of the Court of Appeal, "on April 4, 1895, eight Judges have finally overruled "thirteen; or, putting it in another way, nine members

" of the House of Lords have overruled three members of " that House and three Lords Justices of Appeal." Never mind what the issue might be, this state of things is lamentable. It all arises out of the multiplicity of Courts of Appeal. As Lord Selborne said in introducing the Judicature Act of 1873: "You never can escape by going " through any number of Courts of Appeal from the risk of " differences of opinion in each and every one of them, and " from doubts arising as to whether the last Court decided " better than those before it." Somehow, the reforms of 1873 seem to have left the difficulty very much where it was before. Of course, the evil of doubtful appeals is closely connected with—indeed, it is almost consequent on—our system of legislation. There is the common law of the land, and there is the statute law; and much of the working time of the judicial Bench is spent in reconciling them. Over and over again do we find Judges complaining that those who make new statutes do not know either the common law, or the way to express their intention of amending it in a certain particular, so as to be safe from misunderstandings. Lord Salisbury in 1873 pointed out, as one of the inconveniences of the English legal system, that those who administer the law have too small a share in making it. Legislation, in short, wants more supervision by those who are in the habit of construing and administering the law. We should not then hear such frequent complaints from the Bench of "these wretched " Acts of Parliament," the phraseology of which, when tested with reference to concrete cases, proves so often ambiguous, or vague, or capable of contradictory interpretations. It is suggested that if the Court of Appeal is composed of *ex officio* peers, with the right to sit and vote in Parliament, the country will be put in possession of one great Court of Final Appeal for the whole Empire such as the world has never seen. If this conclusion is just, the only question is whether it is not time that steps were taken to secure for the English people this "high privilege," this " right to have their litigation finally settled, with the least " possible expenditure of both time and money, and by the " highest authority it is possible to obtain." Anyhow, the system can hardly be permitted to remain as it is without perpetuating a scandal.

WATER AND SANITARY AFFAIRS.

THE year on which we have now entered will evidently be marked as the commencement of a new era in the theory of zymotic disease as connected with the water supply. The typhoid bacillus has been fairly run to earth. He is found to be not merely a water-borne creature, but one which revels in polluted earth, whence he is able to assail the health of towns, let the water supply be as pure as it may. Of this we have an example at Chichester, where, though about half the houses in the city are provided with water by a Company whose sources of supply are free from suspicion, typhoid fever has been almost equally divided between these houses and those which derive their water from local wells. Chichester has for a long time exhibited a marked excess of typhoid fever, and this fact is coupled with the circumstance, as stated in the recent Annual Report of the Medical Officer of the Local Government Board, that, despite all the changes and improvements the city has undergone during the last thirty years, the soil on which it is situated has remained "persistently foul." Samples of Chichester earth obtained by Dr. Bulstrode have been found to be absolutely swarming with microbes; and subsequent experiments have shown that in such soil the typhoid bacillus lived and multiplied, whereas in pure virgin soil it languished and died. "The Times" distinctly concludes that typhoid fever, though mainly distributed in the epidemic form either by water or milk, " may also be distributed through some other channel." It is suggested that a protracted life of the typhoid bacillus might afford time for it to traverse comparatively long distances, and to reach water "or air" in localities which for a considerable period had been free from typhoid. Of course, an ordinary well might thus be reached; and the disease once contracted might be disseminated by infection. The real defence appears to consist in such filtration as we find practised by the London Water Companies. To dispollute the earth would be a tremendous enterprise. With the typhoid bacillus roaming about underground, we are never sure where it may appear. But this pathogenic microbe evidently affects particular localities, and having once found a congenial soil takes permanent possession of the territory.

While the Local Government Board have thus obtained assurance that water is not to bear all the blame connected with the dissemination of enteric fever, it is palpable that the epidemics at Maidstone and Lynn have excited a certain degree of apprehension in the public mind. At this juncture, the Board step in with a circular addressed to public authorities, respecting the supply of water in districts "not within the limits of the supply of Water "Companies." Town Councils and other bodies are reminded that where they have themselves constructed or purchased any water-works, it is their duty to provide a supply of "pure and wholesome water;" and that where means of filtration are necessary, these should be adequate, and maintained in a thoroughly efficient condition. It is to be feared the Local Authorities have in many cases come short in the fulfilment of their duty as set forth in the official circular. Ratepayers are not always disposed to be at the cost of improved systems of water supply; and of this there has been a notable example at Lynn. Where a company have to bear the expense, no such obstacle presents itself, and costly schemes of supply may be popular. The inhabitants of towns supplied by companies have, therefore, the better prospect. The feeling—and perhaps we may say the apprehensions—of the Local Government Board may be inferred from the concluding portion of their circular, where they make allusion to "further works" which may be necessary for the improvement or protection of existing supplies. With respect to the Water Companies, the Local Authorities are called upon to make careful inquiry into the sources, nature, and quality of the various supplies in all parts of their district. Where the result of their inquiries is unsatisfactory, the authorities are advised that they "should take all such steps as may " be within their powers with the view of supplementing " or improving the supplies." This passage is likely to be applauded by our London Progressives. The "Standard," while complaining that the Local Authorities have no statutory powers of control over the Water Companies generally, makes the discreet remark that many of the worst water supplies belong to the authorities, while many of the best are provided by the companies.

What may be termed an agitation of the Water Question thus appears to be imminent; and the Local Government Board, with the best of motives, appear as cheering on the Local Authorities to a fight with the Water Companies. Perhaps there will be a fight between the authorities and the Board. It is to be hoped that Mr. Chaplin will exercise his usual common sense, and not allow himself to be carried away by official or popular excitement. The Medical Department are doing well, in showing that typhoid fever is not in all cases due to the water supply. In London there is no sign of any such connection. Shallow wells in villages and towns may harbour the fatal germ; but when the water supply is all that could be desired, the mischief may spread through "some other channel." It happens rather curiously that samples of the Maidstone water, taken in September last, have failed to reveal a single specimen of the typhoid bacillus. The fact that typhoid fever is a declining element in the mortality of the kingdom is enough to show that good work is being done. We are on the right track; and so much has been accomplished in the purification of water, that our experts are now looking into the earth beneath. Another aspect of the water supply is that which has reference to the appropriation of rivers—a subject likely to be increasingly troublesome as time passes on. In London we have the important inquiry which has been entrusted to the Royal Commission under Lord Llandaff, which will inevitably produce a big Blue-book, and which can hardly do much more. As for the London County Council, it has nothing to propose for this year, except to talk to the Royal Commission, and to wage a useless warfare against the perfectly reasonable Bill of the Southwark and Vauxhall Water Company.

Natural Gas in Holland.—A source of natural gas recently tapped at Delft in Holland was last month connected to a small gasholder, and the gas is now used for lighting and cooking. The supply is uniform, and amounts to about 70 cubic feet per day. The gas gives a bright light when consumed with the Welsbach burner. Other gas springs have been found in the same district of Holland.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 30.)

In a week which has Boxing Day at one end of it and New Year's Day at the other, with only the mutilated middle of it left for business, no great degree of activity can be expected. And so last week was quiet enough. But for all that, there was a good firm tone underlying the quiet, which a light touch on the market was sufficient to evoke. This is regarded as a hopeful sign for the New Year; and anticipations are indulged in that, when holiday making is fairly well over, and the public are settling down to serious business, we may see a good revival of activity and enterprise. The Money Market was very strong; the usual demand at the end of the year being as great as ever. Business in Gas was extremely restricted; and changes in value were not numerous. And they do not indicate the general tone of the market, but are each of them assignable to the special circumstances affecting each specific issue. Thus the Metropolitan undertakings were altogether devoid of feature. A few transactions were marked in Gaslight "A," at rather widely varying figures—say, from 314 to 316½; but there was not enough to show a decided bent either way. In South Metropolitan, the dealings recorded only showed a fairly firm tendency; and in Commercials there was next to nothing at all done. Among the Suburban and Provincial undertakings, a parcel of Tottenham and Edmonton coming into the market at once put the price up five points. Among the Continental Companies, depression was apparent in Imperial, which fell back three points, possibly on the faith of the report that the Vienna Municipality have secured the money required to enable them to run alone without the Association. Among the rest, Tuscan pay a reduced dividend; but the quotation has not suffered. The Water Companies were all very quiet, but firm. The only feature is that all the numerous *ex div.* changes are favourable, and leave quotations stronger.

The daily operations were too insignificant for detailed notice.

We append, as usual, a comparative table of the quotations of Gas and Water securities at the close of 1897, and as they were twelve months previously. It will be observed that numerous and considerable advances in value have been scored among the former, although, on the other hand, there are more instances of a retrograde movement than usual. There must, however, always be a limit to advances; and great gains already achieved do of themselves render further gains less feasible, while there is no limit to the possibility of reverses. The ordinary stocks of the Water Companies have done very well; but the secured issues were twelve months ago already at about their highest possible as values go. In most instances, both Gas and Water, the large advances are attributable to increased rates of dividend.

Name.	Prices on Dec. 31, 1896.		Prices on Dec. 31, 1897.		Gain or Loss.
GAS COMPANIES.					
Alliance and Dublin Company, 10 per cent.	23—25	..	24—25	..	+½
Do. 7 per cent.	17½—18½	..	16½—17½	..	−1
Australian (Sydney) 5 per cent. Debentures	107—110	..	107—109	..	−½
Bombay, Limited	7⅞—8⅛	..	6¾—7⅛	..	−1
Do. New, £4 paid	5⅛—6⅛	..	5—5⅛	..	−⅛
Brentford, Consolidated	285—290	..	300—305	..	+15
Do. New	215—220	..	227—232	..	+12
Do. 5 per cent. Preference	140—145	..	145—150	..	+5
Do. 4 per cent. Debenture Stock	130—134	..	134—138	..	+4
Brighton and Hove, Original	255—261	..	273—278	..	+17½
Do. A Ordinary Stock	185—190	..	200—205	..	+15
Bristol, 5 per cent. max.	127—132	..	130—135	..	+3
British	56—57	..	56½—57½	..	+½
Bromley, Ordinary 10 per cent.	22—23	..	25—27	..	+3½
Do. 7 per cent.	19—20	..	20—22	..	+1½
Buenos Ayres (New), Limited	10¼—10⅜	..	9⅛—10	..	−⅜
Do. 6 per cent. Debenture	—	..	97—99	..	—
Cagliari, Limited	29—31	..	30—32	..	+1
Cape Town and District, Limited	16½—17½	..	16½—17½	..	—
Do. 6 per cent. 1st Mort.	57—59	..	59—61	..	+2
Commercial, Old Stock	338—343	..	340—345	..	+2
Do. New do.	255—260	..	255—260	..	—
Do. 4½ per cent. Debenture Stock	150—155	..	154—157	..	+3
Continental Union, Limited	260—265	..	250—255	..	−10
Do. 7 per cent. Preference	215—220	..	213—218	..	−2
Croydon Commercial, A 10 per cent.	315—320	..	315—320	..	—
Do. B 7 per cent.	250—255	..	252—257	..	+2
Crystal Palace Ordinary 5 per cent. Stock	140—143	..	138—142	..	−1½
Do. 5 per cent. Preference	140—145	..	140—143	..	−1
European, Limited	26—27	..	26—27	..	—
Do. £7 10s. paid	18—19	..	18½—19½	..	+½
Gaslight and Coke, A, Ordinary	317—322	..	314—317	..	−4
Do. B, 4 per cent. maximum	110—115	..	113—118	..	+3
Do. C, D, & E, 10 p. c. Pref.	305—315	..	320—325	..	+12½
Do. F, 5 per cent. Preference	147—152	..	150—155	..	+3
Do. G, 7½ per cent. Pref.	212—217	..	222—227	..	+10
Do. H, 7 per cent. maximum	207—212	..	204—209	..	−3
Do. J, 10 per cent. Pref.	305—315	..	319—324	..	+11½
Do. K, 6 per cent. Pref.	172—177	..	182—187	..	+10
Do. 4 per cent. Deb. Stock	137—142	..	138—141	..	—
Do. 4½ per cent. Deb. Stock	150—155	..	155—158	..	+4
Do. 6 per cent. Deb. Stock	203—208	..	205—210	..	+2
Hong Kong and China, Limited	12—13	..	14—15	..	+2
Imperial Continental	210—215	..	218—223	..	+8
Do. 4 per cent. Debs. Red.	100—103	..	99—102	..	−1
Do. 3½ per cent. Debenture Stock Red.	105—108	..	104—107	..	−1
Malta and Mediterranean, Limited	5⅞—6⅛	..	5⅛—6	..	−⅛
Metropolitan of Melbourne 5 per cent. Debenture Stock	111—115	..	112—114	..	—
Metropolitan of Melbourne 4½ per cent. Debenture Stock	108—110	..	109—111	..	+1
Monte Video, Limited	16—17	..	14½—15½	..	−1½
Oriental, Limited	8¼—9	..	8—8½	..	−½
Do. New, £4 10s. paid	7⅞—8	..	7—7½	..	−½
Do. do. 1879, £1 paid	1⅞—2	..	1⅞—2	..	—
Ottoman, Limited	5—5⅛	..	4⅝—5	..	−⅛
People's Gas of Chicago, 1st Mtg. Bds.	102—107	..	104—109	..	+2
Do. 2nd do.	100—105	..	103—108	..	+3
San Paulo, Limited	13—14	..	16—17	..	+3
Sheffield, A	—	..	250—253	..	—
Do. B	—	..	250—253	..	—
Do. C	—	..	250—253	..	—
South Metropolitan, 4 per cent., Ordinary	145—149	..	143—146	..	−2½
Do. 3 per cent., Deb. Stk.	—	..	106—109	..	—
Tottenham and Edmonton, A	270—280	..	285—295	..	+15
Do. B	180—190	..	205—215	..	+25
Tuscan, Limited	14—15	..	13⅞—14½	..	−⅞
Do. 5 per cent. Debs. Red.	101—103	..	102—105	..	+1½
WATER COMPANIES.					
Chelsea, Ordinary	333—338	..	333—338	..	—
Do. 5 per cent. Preference	175—180	..	177—180	..	+1
Do. 4½ per cent. Preference Stock 1875	158—162	..	157—160	..	−1½
Do. 4½ per cent. Debenture Stock	162—167	..	160—165	..	−2
East London, Ordinary	228—233	..	232—236	..	+3½
Do. 4½ per cent. Debenture Stock	162—167	..	162—165	..	−1
Do. 3 per cent. Debenture Stock	105—107	..	105½—106½	..	—
Grand Junction 10 per cent. maximum	115—120	..	122—127	..	+7
Do. 4 per cent. Debenture Stock	150—155	..	147—152	..	−3
Kent	335—345	..	362—367	..	+24½
Do. New, 7 per cent. maximum	215—220	..	215—220	..	—
Lambeth 10 per cent. maximum	271—276	..	303—308	..	+32
Do. 7½ per cent. maximum	222—227	..	225—230	..	+3
Do. 4 per cent. Debenture Stock	150—153	..	147—150	..	−3
New River, New Shares	418—423	..	450—455	..	+32
Do. 4 per cent. Debenture Stock	151—156	..	152—155	..	—
Southwark and Vauxhall, Ordinary	150—155	..	164—167	..	+13
Do. Do. 7½ per cent. do.	147—152	..	155—160	..	+8
Do. Do. 5 per cent. Pref.	173—178	..	175—180	..	+2
Do. Do. 4 p. c. A Deb. Stk.	147—150	..	144—147	..	−3
West Middlesex	310—315	..	315—320	..	+5
Do. 4½ per cent. Deb. Stock	163—168	..	162—165	..	−2

ELECTRIC LIGHTING MEMORANDA.

Gas-Power Electricity Supply Stations—The Adaptability of Gas Engines—The Leyton Station—The Leicester Station Works—Dust Destruction and Electric Lighting.

The leading electrical journals have recently published a good deal of information respecting the equipment and working of electricity supply stations by gas-engine power. The "Electrician" for the 17th ult. contained an article on the subject, and also a description of the Midland Railway Company's installation of this type at Leicester, and an abstract of a report by Professor Henry Robinson on the gas-power central station of the Leyton Urban District Council. The latter report is also mentioned in the "Electrical Review" for the 31st ult. Our former contemporary offers an opinion with regard to the prospects, for the immediate future, of gas-driven electricity generating stations; the assumption being, of course, that no radical improvement of the gas-engine will meanwhile be introduced, to disturb the practice in this connection. "Hitherto gas-engine electric power stations have been classed among supply concerns of low or moderate size; and we know of no instance where gas power has been exclusively used in stations of the first magnitude. . . . We think that the modern gas-engine has amply justified its existence in stations of small capacity . . . by comparison with steam-driven stations of the same size and output. All the examples of well-designed and intelligently worked gas-engine supply stations show the superiority of gas power over steam upon this scale of working; but about really large stations it is a different story." This conclusion is based upon the reflection that large gas-engines are not so superior to small ones in economy as in the case of steam-motors. Hence at present "to equip a large central station with gas-engines would necessitate many more engine and dynamo sets than if steam power were to be adopted; and, though it is not improbable that the cost of fuel in such a case would be lower for gas than for steam power, yet the difference which might exist would be enormously over-balanced by the excess in many other items of cost, such as labour, repairs, oil, &c., that the use of gas-engines would involve."

The foregoing is a very fair statement of the case for gas-power electricity supply stations, and amounts to what nine out of ten engineers would say upon the same question. Our contemporary goes a bit wrong in representing, in another part of the article, "the enormously higher possible and realized efficiencies of the internal combustion engine, as compared with the boiler and steam-engine" as having been the chief consideration with engineers in the first application of gas power to the generation of electricity. Gas-engines were used for this purpose, not on account of their efficiency as heat-engines, but because of their cheapness and handiness in working, and the saving of ground space which they show as compared with steam-power of equal amount. In short, gas-engines were applied to the generation of electricity for precisely the same reasons that have induced their use for other purposes. In one or two examples, unfortunately, mistakes were made in designing gas-engines for this particular purpose; and the result was a disappointment which has operated to discredit the system. Yet from the first the gas-engine has been a favourite source of power for isolated electric lighting plants; and those early central supply stations, like that at Dessau, where the plant was properly designed, have never given their owners any cause to regret their preference for gas power.

Professor Robinson deserves credit, as the "Electrician" has

truly observed, for his perspicacity in recommending a gas-power station for Leyton. This establishment has been at work since September, 1896; and Professor Robinson has reported upon its condition after a year's operation. The present plant consists of three Dowson gas generators, a 20-feet gasholder, four "Premier" gas-engines, the same number of 35-kilowatt dynamos driven by belting, and a double set of accumulator cells of the "Tudor" pattern. The supply is on the continuous current three-wire system, with 300 volts across the outer conductors. The data of the working of the station for a complete year are now available, thanks to Mr. H. Collings Bishop, the Resident Electrical Engineer to the District Council, who has worked out his results with care and candour, so that they throw a good deal of light upon the whole scheme of operations. So far as the electricity supply is concerned, the establishment suffers from lack of business; but, even as it is, the cost of fuel is only ¾d. per unit sold from January to October. This figure will "take a lot of beating" from the dust-destructor enthusiasts. When the plant is running at full load, the fuel consumption will only be 1·07 lbs. per electrical horse power per hour. The known irregular action of gas-motors is corrected in this case by working two or more engines together, with the dynamos coupled in parallel. The action of the machinery and plant generally is reported to be very satisfactory. The gas production gives no trouble, if clean anthracite is used. The producer cinders and a little coke feed the blowing-up boiler. An important paragraph of the report runs as follows: "It is sometimes urged that gas-engines require more oil than steam-engines; but the results at Leyton prove that this is not the case. The first year's working only involved an expenditure of 0·03d. per unit sold, for waste, oil, and water. All other engine-room stores (such as incandescent lamp renewals, arc lamp carbons, &c.), were covered by 0·045d. per unit sold. There are very few steam-engine stations which can show lower figures, even on a much larger scale of working."

The Leicester Railway Station plant consists of a pair of Dowson generators and a 16-feet gasholder. There are six Crossley gas-engines in the power-house, four of 90 indicated horse power with coal gas, and two of 50 brake horse power with coal gas. All the engines are fitted and connected for either coal or fuel gas. Three of the large engines are employed in series arc lighting, and the other large engine and the two small ones do the incandescent lighting. The Midland Railway Company have several electric lighting installations at other stations besides Leicester; but these are all steam-driven. An opportunity is thus offered for showing comparative results; and it is found that there is not much difference in the cost per unit at all these places. The total expenditure at Leicester is 2·80d. per unit. The lowest cost for the steam stations is 2·58d. at Bradford, and the highest 3·16d. at Somers Town (London). This is useful information, as exhibiting what the cost of electricity generation under similar conditions is likely to be.

The long letter of Messrs. Manlove, Alliott, and Co., Limited, on the subject of "Dust Destructors and Electric Lighting" which appeared in last week's "JOURNAL" should have been sent to the "Electrical Review." It is that journal which has been ventilating the question of what the Shoreditch Vestry electric lighting undertaking gains by combining with it the destruction of house refuse; and we only quoted from our contemporary's columns. It should hardly be necessary for us to disclaim any intention of discrediting dust destruction or the utilization of the waste heat resulting from the operation in any way that may be found economical. What we have protested against, and what we shall continue to expose, is the imposture—not to put too fine a point upon it—that the utilization of town refuse or throwing it into the sea has anything to do with the economics of municipal electric lighting. Let Messrs. Manlove, Alliott, and Co. deal with the "Electrical Review" upon the point of the consumption—not the storing—of coal at the Shoreditch electricity supply station. If our correspondents can meet our contemporary's criticism, we shall be quite willing to take note of the fact.

REPORT ON THE STRIKES AND LOCK-OUTS OF 1896.

A BLUE-BOOK has been issued from the Labour Department of the Board of Trade which has been much commented upon in some newspapers. It contains a report by the Chief Labour Correspondent on the "Strikes and Lock-Outs of 1896." Though from one point of view somewhat belated, this official publication has been brought up to date by the inclusion of an introductory note by Mr. H. Llewellyn Smith, the Commissioner for Labour, which shows how much working time was lost through trade disputes during the first ten months of the past year. Compared with this period, and with the three immediately preceding years, 1896 was not a great strike year. Still, the estimated aggregate number of working days lost through disputes in 1896 nearly reached 4 millions. In 1893, the year of the great coal strike, 31 million days' work were lost to the industry of this country, and had, of course, to be paid for somehow. For the first ten months of 1897, the aggregate number of days lost was nearly 7½ millions; so that there is no approach to regularity or order in this class of statistics. Time flies; but it is a surprise to learn that the present is the Ninth Annual Report on Trade Disputes in the United Kingdom. Regarded as a statistical work, the publication is an improvement upon its precursors. The returns of disputes and their results are more complete, which is only what might be expected of the work of a Government Department after the system had been developed in practice.

Statistics are of the first importance as aids to the comprehension of any economic question. With regard to what are called "Labour" questions, they may be truly said to lie at the root of the matter. Are strikes becoming more or less frequent? What are they mostly about? How do they usually end?—Such are the queries that naturally crop up in this connection. These reports of the Chief Labour Correspondent unquestionably throw much light upon the subject; and though the composition of the Department is "suspect" in the estimation of some critics, the head officials know too well what they are about to wilfully garble their facts. At the same time, the importance of these statistics is not easy to appraise. A strike, of course, is a strike; and a day lost in consequence is gone beyond recall. But there are differences. For instance, 1893 was the year of the great colliers' strike, which had a marked effect upon Mr. Burnett's figures relating to time wasted. Still, the coal that was not mined remained in the ground, to be raised another day. On the other hand, when artisans strike and lose time, the industrial productiveness of the country suffers in a way that can never be made good. However, this by the way. The Blue-book shows that for the last five years strikes have arisen mostly out of questions of wages; next come disputes over working arrangements; and "questions of Trade Unionism rank third," as the official scribe artlessly puts it. One may be permitted, in passing, to observe that the hand of the Trade Union may possibly be traced also in some of the two former descriptions of industrial trouble.

It is the official deduction that "the workmen were, on the whole, more successful in gaining their demands, or resisting those of the employers, in 1896 than in the previous years. . . . If the disputes about wages be taken by themselves, this fact is even more conspicuous." The reason assigned for this is that the general condition of trade was good; so that settlements favourable to the men were more easily obtained than is the case when trade is bad or doubtful. In 1896 and in other years, "by far the greatest number of disputes have been settled by direct negotiation between the parties or their representatives." The strike statistics for 1896 were much affected by disputes in the building trades. Now it is often pleaded by partisans of Trade Unionism that the more highly a trade is "organized," the smoother will the work go on. These statistics do not support this view in regard to the highly organized building trades, the characteristic of which is that strikes are directed against single establishments and isolated jobs. This feature of building strikes comes to the front in several ways. Thus, for instance, it is reported that, as regards the results of disputes to the parties concerned, "39·5 per cent. of the workmen obtained their demands, while disputes affecting 27 per cent. were compromised, and disputes affecting 33·4 per cent. resulted in favour of the employers. *The workpeople were most successful in obtaining their demands in the building trades, which during the year were very busily employed.*" The italics are ours. The passage is eloquent. It means that the men "struck" many building jobs included in the year's total of 1021 disputes; and that their successes in this guerilla warfare made the whole returns look favourable to the "strike policy."

The story of the negotiations between the employers and the men engaged in the London building trades is narrated. This history gives a reader the impression that it was only the influence of a period of good trade that enabled a settlement to be arrived at. At Newcastle-on-Tyne, building work was considerably interfered with by a dispute between the bricklayers and plasterers as to which trade should have the laying of floors and some other descriptions of cement work. Ultimately, a schedule defining the kinds of cement work which may be done by each trade was agreed upon. The narrative of the Bethesda quarrymen's strike, which began in 1896 but was not terminated until September last, is one to tax the impartiality of the official chronicler. It is not made clear whether the result of this strike is officially regarded as in favour of the men or of the employer. This is to be regretted, seeing how much misrepresentation has prevailed respecting the character of the settlement. It is left to be discovered by the reader what difference, if any, exists between the terms of employment accepted by the men in August and those rejected by them the previous May. If we turn to the table of strikes, in which the Bethesda Quarry dispute is entered under "Quarrying," with the reference number 369, it will be found stated as the "cause or object" of the dispute that it "was for reinstatement of fellow-workmen suspended in connection with agitation as to general grievances;" while as the "result" it is stated that "conciliatory conference resulted in general agreement as to grievances and re-starting of all men." While all this is in a sense true to the letter, it is far from being an adequate or a just summary of the facts.

The same tendency to do less than justice to the employers and more than justice to the men betrays itself in the account of the dispute that broke out in May, 1896, in the Hartlepool and Tees district. It is the same with the Keighley engineers' strike of May, which the Trade Union persisted in keeping open until the following May, though the employers had filled the

strikers' places long before. The restlessness of the A.S.E. was responsible for a strike at Earle's Shipbuilding Yard at Hull, against the employment of a machine worker to work a new milling-machine; but there were also complications between the engine fitters and the brassfinishers which it required a reference to Sir Courtney Boyle to settle. The same source of trouble manifested itself during July at Yarrow's works on the Thames, when Sir Benjamin Baker was called in to mediate between the fitters and the boilermakers. Then came the outbreak at Dunsmuir and Jackson's, Govan, which was the prelude to all that has happened since in this distracted trade. It is impossible to peruse these accounts of workshop disputes and their causes without feeling that somehow the mastery of the shops must have become transferred from the original holders, so that the employers who paid the men had lost the power of saying what the money should be paid for.

In the tables giving a detailed statement of every trade dispute included in the list, there are several curious entries. Some of the strikes in the building trades affected as many as three or four men; and the official formula for representing what happened to these multitudinous victims of the employers' distaste for Trade Union dictation is: "Places filled by other men." One strike of bricklayers, in which 45 men were involved, was against the discharge of the Union ticket steward. It began and ended on the same day—the "men obtained work elsewhere, and were replaced." On another occasion, at Penge, two bricklayers struck against the employment of a labourer to lay bricks. The dauntless pair withstood the employer's scorn for 16 days; but the only result was "works closed to Union men." Of course, this was a strike; but it is playing the game of the statistician rather low to chronicle such small matters.

The gas workers do not occupy much space in these tables. Three cases of striking by this class of labourers are entered; the most important being that of Plymouth, where 240 men struck on Dec. 18 "for reduction in hours, and advance in wages to some classes of men." The result was "demands conceded after conference," without the loss of a day. The next case was at Rhyl, when six men struck for more money on March 7, and were "replaced." The only other gas strike was at Rotherham, where 30 stokers stood out a day against having to wheel and trim coal. Here work was resumed on the Sheffield basis of wages pending arbitration. Some five months later an award was given for an advance of wages of 3½d. per day, from date of application.

This Blue-book should certainly be procured and examined by all employers of labour, as, subject to the observations expressed here, and others that will occur to readers of this class, the report is a valuable record of facts. The Labour Department have their own methods to thank if some of the matter is not universally regarded as above criticism.

THE PRESERVATIVE PAINTING OF IRONWORK.

The subject of the preservation of iron and steel structures by painting is one of the first importance to engineers; yet it is one that is rarely dealt with satisfactorily in professional papers. As the writer of a recent article in the "Engineer" remarks, though the necessity for painting all ironwork exposed to damp and air is recognized, nevertheless when two, or sometimes three coats of something or other "in oil" have been applied anyhow to the surface, it is too often imagined that everything needful has been done to prevent corrosion. This is not by any means the last word that modern science has to say on the subject. The article proceeds to recount what is the latest chemical view of the nature and necessities of the case; and we propose to extract therefrom the essential part.

It has been remarked elsewhere that the chemistry of so common a reaction as the rusting of iron is by no means simple. Everybody knows that iron rust is an oxide of the metal; but the oxidizing is a roundabout process, because the oxygen in neither dry air nor pure water will attack massive iron. Air, water, and carbonic acid altogether are needed to make iron rust in the first place; but when the rusting process has once begun, it possesses within its own product the necessary aids to its continuing action until all the metal has been converted into red rust. The first essential condition for the preservation of iron or steel is therefore that the surface of the metal shall be cleaned from all rust and mill-scale before being painted. Unfortunately, it is easier to state this requirement than to say conclusively how it is to be secured in practice, as iron and steel members go into all large structures in such a variety of states of preservation. Some have lain long in the constructor's yard, and others are worked blue from the rolling mill. Unfortunately also the constructor has no interest in the permanent preservation of his work, and is apt to regard as a hindrance and a nuisance anything ordered to be done to the metal specially with a view to its life after it has passed through his hands.

Assuming, for the purpose of this article, that the ironwork is in a fit state to be painted, the next consideration is as to what paint is, and what it does. "It is a hard saying," remarks our contemporary, "but unfortunately none the less true, that scarcely any tradesmen are so ignorant of the actual composition of the material they employ as painters. . . . There is no justification for jumping to the conclusion that what is sold as 'paint' is paint; in fact, especially when purchased retail, it usually is not. In days when everybody has a smattering of chemistry, and therefore understands the art of adulteration, it would be unique if it were." Real paint may be defined as "a mixture of a colouring matter and an oil, thinned down to a suitable working consistency with turpentine, and capable of drying to a hard insoluble skin on exposure to air." Is it necessary that there should be turpentine in the mixture to constitute it a true paint? The writer observes that the drying of paint must not be confounded with the drying of a substance wet with water. The word "drying" is used in a particular sense in connection with paint, and means the changing of the liquid paint medium into a solid body. It is absolutely essential for the composition of a good paint that the liquid vehicle is pure linseed oil, either boiled or raw; it is desirable that the pigment should be permanent in colour, and not likely to injure the drying power of the oil; and it is preferable that the turpentine should be the genuine article, and not resin spirit. Resin oil and spirit are, in fact, the evil thing in paints and varnishes, always to be most carefully avoided. Resin oil never dries through and through; and resin, when it enters into the composition of cheap spirit varnishes, remains on the work only as a brittle residue of evaporation. Really good oil varnishes, composed of copal or other hard gums dissolved in linseed oil and thinned with turpentine, make very efficient vehicles for paint; but they are too expensive for common use. "In a word, when price is taken into consideration, the substance has yet to be discovered which shall, under the influence of oxygen, dry up to anything approaching in value the tough, leathery, elastic skin characteristic of sound, unadulterated linseed oil."

The examination of commercial paints is a business for the trained chemist; and when the paint for any important structure, or for extensive use in a large establishment, is contracted for, prudence dictates that the article should be subjected to analysis at intervals. Even with the best paint, however, ironwork will sometimes continue to rust under the coating. It has been generally accepted as the explanation of this phenomenon that the air and moisture penetrate to the metal through a large number of cracks in the dried paint, which have their origin in the different rates of expansion and contraction for temperature possessed by the iron and the paint. The writer whom we are now following rejects this explanation as defective, because it supposes the paint to have dried to an enamel-like brittleness, which it will not do if properly mixed with the pure ingredients named. Raw linseed oil, with which paint for indoor work is usually made up, dries to a very pliable film. Boiled oil, which goes to the composition of outdoor paints, dries to an india-rubber-like skin. Experiments tried recently in Germany have indicated conclusively that paint films when dried are perfectly free from holes, and, while fresh, air as well as water tight. It was also discovered, however, that the skins were hygrometric; swelling in the presence and by absorption of moisture. In this condition they became porous, and readily allowed air and water to pass through them by a process of diffusion. It was found that the rate of diffusion—that is to say, the porosity of the paint skins—was influenced in direct ratio by the quantity of pigment. Now the relationship between the proportions of oil to pigment in a paint depends upon the viscosity of the medium on the one hand, and the physical character of the pigment on the other. "The thinner the oil, the larger the amount of pigment needed to 'body it up' efficiently; and, with the same varnish, the greater the specific gravity of the pigment, the more must be put in to produce the proper effect. Raw oil, for instance, will 'carry' about eight times its weight of dry white lead; but it is rendered almost solid by less than its own weight of lamp-black."

According to these observations, the hypothesis that paint on structural ironwork fails through cracking must be abandoned, and the continued rusting of the metal ascribed to the porosity of the paint-coats. The conclusion seems irresistible from the evidence offered; and the only remaining question is that of the consequences. It appears certain that the quality of permanence is denied to all paint exposed to the weather by its very nature. Therefore one must not expect too much of it. On the other hand, the knowledge of why paint fails, and how, may lead to the reduction of the rate at which failure sometimes sets in. These considerations give rise to the following suggestions as to the properties of good paint for ironwork, in which, it is to be noticed, there is no mention of any particular virtue as appertaining to a pigment, or class of pigments. The surface of the metal should be cleaned as perfectly as possible from rust and scale. The paint should not dry more quickly than the exigencies of the work warrant. The addition of driers by the painters is deprecated. The dried film should be sufficiently elastic to avoid danger of mechanical injury or cracking when the metal expands by heat. At least three, or better still four, coats should be applied in order to reduce the porosity. Only those pigments should be employed which possess good covering power, which yield a paint adhering strongly to the metal, and which, having the lowest specific gravity consistent with these requirements and with a sufficiently low price, will carry the largest proportion of vehicle; thus allowing the maximum of oil or varnish to be applied to every part of the surface of the metal. The recommendations are somewhat vague; but they are calculated to be of service as a standard.

OBITUARY.

MRS. CHESTER.

WE regret to have to record the sudden death, on New Year's Eve, from failure of the heart's action, of Mrs. Kate West Chester, wife of Mr. W. R. Chester, of Nottingham. The sad event was totally unexpected; and Mr. Chester's friends will sympathize with the family in the terrible shock and heavy bereavement they have suffered. Mrs. Chester was personally known to many gas managers through her regular companionship of her husband at the meetings of the Incorporated Gas Institute during a number of years. The funeral is to take place to-morrow, at the Church Cemetery, Nottingham.

Mr. THOMAS PORTER BULMER, the Vice-Chairman of the York Gas Company, died early on the morning of Christmas Day from an apoplectic seizure. He was an old and much respected citizen, and had taken an active part in public affairs.

By the death of Mr. CHARLES HARRISON, M.P., which took place rather suddenly on the 24th ult., the Progressive members of the London County Council have lost one of their most conspicuous colleagues. Mr. Harrison was Vice-Chairman of the Council from 1892 to 1895, and from 1888 to 1895 was Chairman of the Parliamentary Committee. The three great public questions to which he devoted his attention were the taxation of land values, the unification of London, and the municipalization of the water supply. It may be remembered that he gave evidence at great length before Lord Rathmore's Committee in 1895. He was one of the Council's representatives on the Thames Conservancy Board, and was very zealous in his endeavours to improve the condition of the river. He was returned to Parliament for Plymouth at the election of 1895.

PERSONAL.

Mr. J. O'GRADY, formerly Manager of the Castlebar Gas-Works, has been appointed Manager of the Mountmellick (Queen's County) Gas-Works.

Mr. WARD, of the Kirkintilloch Gas-Works, has been appointed Manager of the Stevenston Gas-Works, near Saltcoats. He has been at Kirkintilloch for upwards of fifteen years.

Mr. C. RICHMOND has succeeded Mr. E. A. Harman as Superintendent of the Swan Village works of the Birmingham Corporation. Mr. Richmond was for more than five years with Mr. H. Hack, at the Saltley station; having previously been for twelve years in the service of Messrs. Ashmore, Benson, Pease, and Co., Limited.

Mr. CHARLES HOWARD, for the past 33 years with the South Metropolitan Gas Company, and for 26 years of this long period of service their Chief Inspector, retired on a pension as from the end of 1897—bearing with him the hearty good will of all the officers of the Company and those with whom his business brought him in contact.

At their meeting last Tuesday, the Gas Committee of the Stalybridge Corporation sanctioned prolonged leave of absence to Mr. W. CARR, the Gas Engineer and Manager, in order to enable him to visit the Canary Islands, in the hope that the voyage across the Atlantic may restore his health, which his late serious illness has gravely affected. His stay in the Canaries may last two, or possibly three, months; but it will probably be shortened should his recuperation prove speedy. The journey has been undertaken on the urgent counsel of Mr. Carr's medical attendant; and we trust it may be the means of restoring him to his former health. He will leave England with the assurance that this is the wish of all his friends and professional colleagues.

NOTES.

Gas Light Superior to Candle Light.

An interesting review of artificial sources of light in respect of their hygienic qualities was recently made by Heer A. Varech in "Vragen van den Dag." Notwithstanding the reputed pleasantness to the eye of candle light for reading and writing, Heer Varech unconditionally and absolutely condemns the use of candles for all purposes of illumination, and considers the light of gas far superior to candle light. Strangely enough, however, he is of opinion that the light given by the most perfect petroleum lamps is hygienically the equal of gas light.

Argon and the Periodic Law.

The relation of the gases argon and helium to the "periodic law" of Mendeléeff is discussed in "Nature" in the course of an appreciative notice of the English translation of the sixth edition of the great Russian chemist's "Principles of Chemistry," which has recently appeared. It is recorded here that, having become convinced in or about the year 1869 that the atomic weights and properties of the elements are mutually related in a certain manner, Mendeléeff did not hesitate to alter accepted atomic weights when required to fall in with the scheme, and to predict the properties of their undiscovered elements. Neither De Chancourtois, to whom the French ascribe the discovery of the periodic law, nor Newlands, who is put forward by the English as the discoverer of this grand generalization, nor L. Meyer, who is now cited by many as its founder, ventured to do anything of the sort. What, after all, is a "law of Nature" further than a compendium or summary of a series of observed agreements? If exceptions to such a "law" are found, this merely implies that the induction is at present incomplete. Inasmuch as argon and helium find no place in the so-called periodic law, Mendeléeff still inclines to the idea that argon is no element, but only a polymeride of nitrogen, or N_3. This hypothesis the writer in "Nature" declares untenable. Argon is a distinct gas, and both it and helium can at present be regarded "only as a kind of chemical monsters brought unexpected and unwelcome, like the cuckoo, into the previously happy family of the elements, where no place is provided for them."

Large and Small Gas-Engines.

The development of the gas-engine is being realized at both extremes of the scale of magnitude. Messrs. J. & P. Hill, of Sheffield, have brought out a gas-engine of the "Otto" type specially designed to meet the requirements of users of small power, whether for workshop or laboratory purposes. This engine is lightly but strongly made, and is of exceptional strength for the extent of floor space occupied. It has a sensitive governor, driven by worm gear from the crank-shaft. Means of adjustment are provided whereby the speed of the motor can be altered while running. Adjustable wearing parts, and extra long bearings characterize the design of this engine, which is claimed to have a small consumption of gas. On the other hand, a 200-horse power "Premier" gas-engine, made by Messrs. Wells Bros., of Sandiacre, was recently illustrated in the "Engineer." In this type of engine, the principle of the "scavenger" charge of fresh air sweeping out the combustion chamber is followed with satisfactory results as regards density of charge and avoidance of premature explosions. The fine example in question is a tandem engine; and it has the following action: There is an air-pump behind the front piston, and on the out-stroke air is drawn into this pump, and also into one of the cylinders—say, for instance, the front one, which also receives a charge of gas at the same time. During this stroke, explosion and expansion of the charge are taking place in the other cylinder, to be followed on the return by an admission of the air from the pump. The two gas and air cylinders are alternately filled, the charge compressed, fired, and swept out by air. There is thus an explosion at each out-stroke, in one or the other of the cylinders, and a "scavenger" charge swept through at every back-stroke. The mechanical details of the engine are also claimed to present certain advantages.

The Strength of Brickwork.

The subject of brickwork tests was discussed at a general meeting of the Royal Institute of British Architects, reported at length in the "Builder" for the 18th ult. The report on the third series of experiments conducted by the Science Standing Committee was read by Mr. W. C. Street. It stated that the experiments terminated last spring with the crushing of twenty short lengths of brick walls, all about 6 feet high, 27 inches long, and 18 inches thick. The Committee did not see their way to deduce any rules from the results of these experiments; but they offered in the meanwhile a few general impressions. The resistance to crushing of brickwork in lime mortar seems to vary from one-sixth to one-eighth of the resistance offered by the brick itself; while in cement mortar it varies from one-half to one-fifth of this strength. So that while cement mortar materially aided the weaker bricks in their combined strength, it could not greatly affect the ultimate power of resistance in brickwork made of a harder variety of brick. The behaviour of the test work did not seem to be affected by the rate at which the loads were applied. All the mortar was well crushed and disintegrated long before the final collapse of the work. In settling upon the permissible working load, care must be taken to stop short of a load that would deform the work. Taking a safe load at one-fifth of the crushing load, it might be assumed, from the results obtained, that in lime mortar stock brickwork is equal to about $3\frac{1}{2}$ tons per square foot, gault and Fletton to 6 tons, Leicester red to 9 tons, and Staffordshire blue to 23 tons. Under the average or ordinary conditions of practice, the form of the brickwork does not greatly affect its strength. The work in lime mortar seemed to come to its strength as fully in three as it did in five months. Professor Unwin severely criticized the proceedure of the Committee; but he appeared to accept the results already given as fairly accurate. Professor Aitchison, the President of the Institute, emphasized the necessity of always using the standard gauge of one of lime to three of sand for lime mortar, with plenty of grout to keep the work damp until the mortar had crystallized instead of dried to powder, as it would do if left too dry.

The Imperial Continental Gas Association in Holland.—The Association have made an offer to the Town Council of Amersfoort, near Utrecht, to take over the existing gas-works from the present concessionaires, and supply gas to the town for a term of 25 years. Municipal works were in contemplation; but the scheme may now be abandoned in favour of a concession to the Association.

COMMUNICATED ARTICLE.

BOTH SIDES OF THE LEDGER.

By Norton N. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The ordinary acceptation of this term, as applied to any individual customer, is to place the sums he owes on the one side and the amounts paid on the other. But the ledger account with a customer may be regarded in a wider sense; on the one side we may place the sums received from him, and on the other the expenditure on his behalf. It is usual to talk about good and bad lines, profitable and unprofitable transactions, and so on; and these expressions assume that a balance of this kind has been struck. In some businesses, this extended ledger account may be a very simple affair. Take, for example, the case of a commission agent who buys £100 worth of goods and sells them for £105. Where the profits are a fixed percentage, and the establishment charges trifling as compared with the actual turnover, the profit made on each customer can be readily ascertained. But the manufacture, storage, distribution and sale of gas involves so many items, that an accurate valuation of profit earned on each customer cannot be closely arrived at. Yet gas engineers are frequently called upon to make such valuations. Questions such as that of the prospective supply of gas to a large gas-engine, the owner of which is undecided whether to make his own gas or to get rid of the engine and use steam instead, are continually arising; and the engineer is asked to report if the circumstances of the case are such as to warrant a special rebate being offered in the hope of securing or retaining the customer. The position is somewhat similar to that of a contractor putting in a price for erecting a building complete, which will be considered in competition with others. The sharper the competition, the greater the necessity for accurate cost books. For his own guidance, the contractor prepares a ledger account in respect to each transaction. On the one side, he puts the cash received, or in other words the contract price; and on the other, the expenditure for material, labour, &c. A balance should remain, showing the actual profit earned. In some respects the supply of gas may be called a contract, seeing that it is supplied under fixed conditions as to price, and any question as regards an individual consumer invariably takes the form of allowing a discount or rebate. Under ordinary circumstances, the company cannot put a premium on the regular rate.

The annual revenue account may be regarded as a concrete ledger account with the consumers as a body; and for purposes of comparison, it is usual to divide each item by the number of tons of coal carbonized, or by the quantity of gas made or sold, and so arrive at the *average* cost of the gas, or at the *average* working expenses, and sale of products per ton of coal. Computations of this sort, however, do not alter the *concrete* character; and they cannot be applied, without a great deal of adjustment, to individual cases. The actual cost of each customer is a question far more complicated than a simple ratio according to the quantity of gas he consumes. It will be affected by the regularity or degree of variation in the rate at which it is taken, and especially by the intervals of inaction. This latter point is very prominent in connection with the supply of electricity; respecting which it has been said the cost of being "ready to supply" may be greater than that of actually supplying. When a consumer has the service-pipe connected or laid on to his premises, the suppliers accept the responsibility of giving him a supply up to the full capacity of the pipe, at any time when he wants it, day or night, Sunday or week day. He has a place in the rental and meter books; he occupies a proportionate share of the meter inspectors', clerks', and collectors' time and attention, whether the actual business done is large or small. An underground railway signal-box, a private house, a bank, or a place of worship may each use a similar quantity of gas—say, about 100,000 cubic feet per annum—but under very different circumstances. The first takes a regular supply, hour by hour, throughout the year, with no interval of inaction, at the rate of about 12 cubic feet per hour. The second takes a varying quantity, commencing at dusk and turning out about 11 p.m. each night, ranging from a minimum at Midsummer to a maximum at Christmas, and having periods of inaction averaging something like 18 hours out of the 24, or 75 per cent. of the whole. The third uses no gas at all for nine months out of the year, and during the remaining period takes a larger quantity at a rapid rate for an average of perhaps two hours a day; the period of inaction being about 98 per cent. The fourth uses no gas for three summer months, and at other times takes a large quantity once a week on Sunday evening. In practice, the gas company find themselves called upon to supply a large variety of customers, and a general levelling up takes place; leading to a fairly regular demand throughout the year according to the season. It gradually decreases during the first half of the year, and follows a corresponding increase during the second.

So far we have been considering the use of gas for lighting only. The matter becomes still further complicated when we take in gas-fires, gas-stoves, and gas-engines. But the acquisition of fresh lines is an advantage, as adding to the number of conditions of demand, and thus tending to increase the levelling up action. If the company were called upon to supply a district composed entirely of one class, great inconvenience would follow, except in the case of the underground signal-box, as the maximum demand would be short and irregular. A district of banks would want absolutely no gas all the summer, or at night; and one of churches would want but little all the week. Gas could not be sold at anything like ordinary rates under such circumstances. But take a district of two classes, and the conditions are improved; with three, they are still better. The addition of each distinctive class of user further improves matters. Here we have one of the factors that have contributed to the steady reduction in the price of gas. The introduction of gas cooking-stoves, or of any other new line, tends to the benefit of the whole district. So we have observed two points: Each consumer represents a certain fixed charge, whether he takes takes little or much gas; and the actual cost to the company may depend more upon the way in which he takes his supply than upon the actual quantity consumed. Working under a uniform rate, it is possible to make a large loss on one customer and an exorbitant profit on another; and a condition of things may exist resembling the assessments in a badly valued parish—some paying more than their fair share, and some less.

The sharper the competition to be encountered, the closer will be the attention paid to "both sides of the ledger." When it is proposed to cut in with existing traders, and to secure a share of business by underselling, the costs are valued to the fraction of a penny; but the gas industry, from its first inception, has been satisfied to deal with the spontaneous demands. In other lines, we hear of armies of "drummers" being employed, and of special advertising agents; and the selling department forms a conspicuous feature in the expenses. While they have been straining every nerve and applying a high degree of skill to extending their business and increasing their customers, many gas companies have never solicited a single consumer, and yet find the business continually increasing. It is interesting to speculate as to what the dimensions of the gas business would be to-day, if travellers had been sent round to solicit business or make a general canvass of the district, and the thing had been actively pushed from the first. But some have been absolutely indifferent to new business; and a general disadvantage attendant upon such a favourable state of affairs is that the actual requirements of the customers are not studied, as they would be under more exciting circumstances. This has been further encouraged by the feeling of security that follows the possession of a Special Act. Beyond a general idea as to the desirability of selling gas at the lowest price consistent with a fair profit, the working expenses have not received anything like the amount of attention usual in other industries, in these days of cutting and competition. Further, we must remember that gas was a new thing. Water, and perhaps other natural products, had been distributed; but gas was the pioneer in artificial products, involving some cost in their preparation in the way of materials and labour, sent out by means of conduits from a central station. Electricity, steam, compressed air or water, &c., have been able to profit by the experience of gas companies; but when gas was first introduced, there was absolutely no experience to go upon. The system was new and untried; and consequently fallacious notions were accepted, and gradually became established by custom into the position of proved axioms. Nothing could be proved for or against them then; but in the light of present experience, it is possible to assess them at their proper value.

One of these was the doctrine of a uniform price. A less robust industry might have been throttled by such a restriction; but it appealed to English sentiments of fairness and justic e, and found favour all round. Even at this day, it does not want supporters. The representatives of the consumers have fought hard for this principle, in Parliament and elsewhere; and they imagined they were securing a decided victory, and a substantial benefit for the public, when it was agreed that the user of 100 cubic feet of gas a year should be charged exactly *pro ratâ* with the consumer of 100,000 cubic feet a week. People who promoted consumers' companies, and called themselves "consumers'" directors, or "consumers'" managers, announced their adherence to the principle; and those who looked at it from a shareholder's point of view, only thought it appeared feasible and fair and regarded it as a judicious concession to the public sentiment that would cost them nothing. So the uniform rate became a power in the land; and to this day there are those who talk about the injustice of differential prices. It is the more remarkable that the uniform rate should have been so laboured as regards the gas industry, because it has attracted little attention in other lines. The scale of prices of electricity, in some instances, ranges from 7d. to 1½d. per unit; and in the supply of heat or power, the tendency is towards differential rates. The plea of the "justice" of a uniform rate cannot be supported from the accounts, as it assumes that the actual cost of each customer varies *pro ratâ* with the quantity consumed. The claims of strict justice could only be satisfied by charging each customer, first with the actual outgoings on his behalf, and secondly with a proportion of the profit—*i.e.*, the amount required to pay interest and dividends. The charges, as we have seen, are affected by many conditions other than the quantity of gas actually consumed.

This has been partly recognized from time to time in an indistinct kind of way, and from motives that savoured more of

expediency than of principle. Departures from the uniform rate were made as a concession to the demands of customers, or from motives of policy, as a means of retaining existing business or of securing new lines. First, there was the claim of the large consumer, leading to the introduction of a sliding-scale of discounts according to the quantity consumed. In gas, as in all other things, the large customer is able to talk the loudest; and his claims secure recognition on account of his influence, rather than from a sense of their justice. It is felt—and quite correctly in the case of the supply of gas—that the withdrawal of his custom would affect all concerned, shareholders and consumers, and that some concession is desirable to avoid such a catastrophe. It is true that an investigation of the accounts shows that much may be said in support of the justice of such a rule; but the system of discounts according to quantity of gas consumed is not introduced voluntarily as a fairer way of doing business than the uniform rate, but simply as a concession to a demand. Then there is the practice of charging a higher price to outlying townships. This was also a matter of arrangement, more frequently based upon arbitrary figures than upon a careful valuation of the actual additional cost of distribution, &c., concerned. The question of day or summer consumption, and the possibility of offering special rates in the hope of securing it, unlike the other variations, were founded upon a direct examination of the accounts. The sellers were struck with the waste of productive power as represented by the extent of manufacturing and distributing capacity laying idle all the summer, or through the hours of daylight. They saw that the expense of maintaining a line of main was the same, whether it was used to its full capacity for 1, or 12, or 23 hours out of the 24; that the same argument applied to land, gasholders, and most of the other items represented in the capital expenditure; and that the expense of booking and collecting an account of £5 was the same as for 5s. Therefore the differential rate for stoves and engines came in. But the expectations were not fully realized; for in practice it is found that the gas cooking-stove is used all the year round, and not in the summer only, and that gas-engines are employed during the hours of darkness as well as by daylight. Yet the advantage of the new lines of business is found by the accounts to be so marked as to warrant important concessions with a view of obtaining or retaining the same.

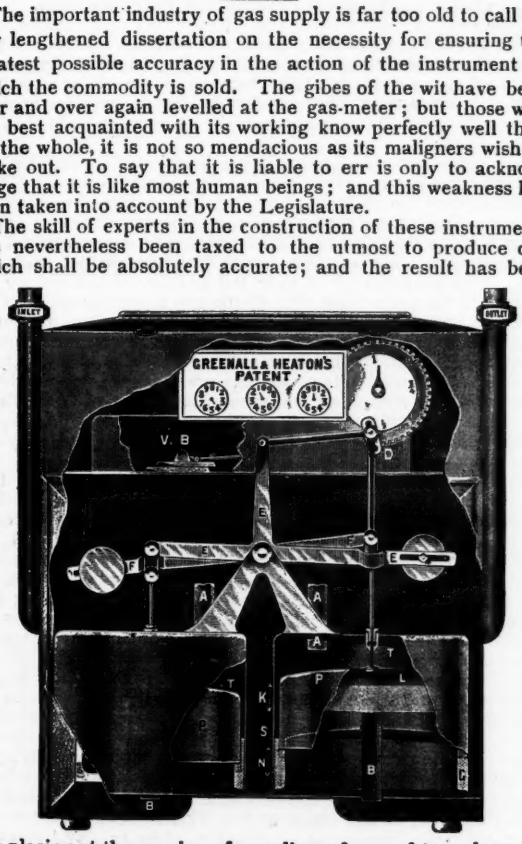
(To be continued.)

TECHNICAL RECORD.

GREENALL AND HEATON'S "POSITIVE" METER.

The important industry of gas supply is far too old to call for any lengthened dissertation on the necessity for ensuring the greatest possible accuracy in the action of the instrument by which the commodity is sold. The gibes of the wit have been over and over again levelled at the gas-meter; but those who are best acquainted with its working know perfectly well that, on the whole, it is not so mendacious as its maligners wish to make out. To say that it is liable to err is only to acknowledge that it is like most human beings; and this weakness has been taken into account by the Legislature.

The skill of experts in the construction of these instruments has nevertheless been taxed to the utmost to produce one which shall be absolutely accurate; and the result has been



the placing at the service of suppliers of gas of two classes of meters—wet and dry—which are both largely patronized, thanks to their own special merits and to the advocacy of their respective partisans. It has been recognized, however, that perfection has not yet been attained in either case—that, in fact, excellent as these meters are, they possess certain disadvantages which it would be desirable to remove. Two of the most recent workers in this direction are Messrs. Greenall and Heaton, who some time ago set themselves the task of producing a meter which would not require leather in its construction, would dispense with the use of water, and would not be subject to the occasional uncertainties of measurement and working which occur with the meters now in general use. The result of their labours has been the production of a meter, the action of which they consider to be so satisfactory as to justify them in giving it the name which stands at the head of this article. The meter is not unknown to readers of the "JOURNAL," as it was described and illustrated in our "Register of Patents" on Sept. 22, 1896; but it may be of interest to give a further description of it by the aid of the accompanying diagram.

It will be noticed that the "Positive" meter has two metal measuring cylinders, divided into separate chambers T and L by a hollow cylindrical piston P, which is sealed with glycerine, placed in the narrow annular space G, between the inner and outer parts of the cylinders. Each chamber is connected by a gas-way A or B to its respective valve-port. The pipe A supplies and exhausts from the top chamber T, above the piston; B supplies and exhausts from the lower chamber L under the piston. After correct adjustment, the length of stroke of the piston is fixed and definite; therefore, the displacement of gas at each stroke is positive and invariable. The light dotted space opposite K indicates the displacement of gas at each down stroke; a corresponding displacement, of course, taking place, out of the upper chamber, during the up-stroke. S shows the height of the glycerine seal-line. When the piston is at the top of its stroke, its bottom edge is sufficiently deep in the narrow annular reservoir of glycerine to seal against the slight difference between the pressures above and below the piston. The initial pressure, practically, does not affect the matter. For instance, the meter, with half-inch seal, may be worked with 2, 4, or 6 inches pressure, even with an open outlet. The width of the annular space for the glycerine is only about $\frac{3}{16}$ inch. If the meter is overturned, none of the glycerine can get into the gas-ways or be otherwise lost. The double arrow N shows the top and the bottom of the piston stroke. The measurement depends entirely upon the length of stroke at which the pistons are adjusted and fixed, and will not be affected by any subsequent variation of the height of the glycerine seal-line. When once the stroke of the piston has been adjusted and fixed correctly, it must remain without variation. One piston is half a stroke in advance of the other; thus each covers the other over the centre—giving a continuous and steady flow of gas. In the above diagram, the right piston is shown as having just passed over its top centre and commenced its downward stroke; while the left-hand one is about mid-stroke, going down. In actual working, the loss of pressure between the inlet and the outlet has been found to be only about half a tenth—showing that the friction is practically *nil*.

The action of the meter is as follows: The gas passes through the inlet into the valve-box V B, in which are two slide-valves, which regulate its flow to and from the cylinders. The gas is admitted both above and below the pistons through the pipes A and B. To make the accompanying diagram more simple, the channels connecting pipes A and B with the valve-box are omitted; these being readily understood. The slide-valves are actuated by a double crank-shaft D; the cranks being set at right angles. Motion is transmitted from the pistons to the valves by means of two independent levers E and F (actuated by their respective piston-rods), one of which is a treble-armed, and the other a double-armed lever. In both levers there is one arm attached to the piston, and one arm on which is a balance-weight to balance the piston. Rods connect one arm of the treble-arm lever E and one end of the double-arm lever F to one and the same stud, on a suspended lever fixed to the double crank-shaft D, which actuates the valves. This lever has a circular motion, and is made to revolve continuously in one direction by the pistons. In the lever is a slot, the position of the stud in which serves to regulate the length of stroke of the two pistons, and thus enables the exact quantity of gas desired per stroke to be correctly fixed; the stud being capable of adjustment in the slot. On the end of the double crank-shaft is a pinion, which actuates a dial recording apparatus of the usual kind, through the spur-wheel W, one revolution of which is equal to 1 cubic foot of gas.

A rough and incomplete working model of the meter was submitted some months ago to Mr. Thomas Newbigging, who expressed a high opinion of it. In October he tested with most satisfactory results a completed meter, fitted with 5-light valves, which has been passed as satisfying the requirements of the Sale of Gas Act; his previously expressed opinion, that the meter "combines the advantages of both the wet and dry meters, without any of the deficiencies of either," being still further confirmed. Professor Goodman, Assoc.M.Inst.C.E., of the Yorkshire College, Leeds, who has examined a "Positive" meter in operation at the Leeds Meter-Testing Office, reports his inability to discover a single weak point in it worth considering; while the Official Meter Tester (Mr. Charles Buckley) says the results of his tests have exceeded his most sanguine anticipations. Mr. Frank Livesey has put one of the meters through certain tests, and found it worked satisfactorily. Other expert opinions are equally favourable. The "Positive" meter, therefore, comes before gas engineers with good credentials.

WATER POLLUTION AND ITS CORRECTION.

At the Meeting of the Society of Engineers on the 6th ult., a paper on the above subject was read by Mr. R. E. MIDDLETON, M.Inst.C.E. The following are some extracts therefrom, with notes on the discussion to which it gave rise.

The author began by saying that the recent epidemics of typhoid fever at Maidstone and King's Lynn had forced upon public notice in an exceedingly unpleasant, but most practical manner, the fact that, while water is one of the primary necessities of existence, it may become, unless carefully safeguarded, a subtle poison, carrying with it disease and death. At Maidstone the notified cases of the disease have numbered some 1770 out of a population of 32,145, or 5·5 per cent.; while the deaths have numbered 119, or 6·72 per cent. of the reported cases. At King's Lynn, the cases recorded are 297 out of a population of 18,360; while the deaths have been 18; being 1·62 per cent.

From time immemorial, running water has been used for two separate and antagonistic purposes—as a source of water supply and as a receptacle for refuse; and so persistently have people "put the cart before the horse," that, even in very recent years, it has been authoritatively stated that the first use of running water is to receive refuse. It is necessary, under these circumstances, to lay great stress on what might otherwise be considered a truism—viz., that water is provided in the first place for dietetic and cleansing purposes, and that the removal of refuse must be subordinated to this first and most important requirement.

Though it has been proved by statistics that the first element of aggregated health is to be found in a pure and sufficient water supply, the Legislature has insisted much more strongly on the necessity for the removal of refuse than on pure water. This is clearly shown by the very tentative wording of the Rivers Pollution Act, 1876, which is so elastic that it has been next to impossible to enforce the purification of sewage matter in an efficient manner, unless the authorities themselves are anxious to deal with it. Water which has passed over or through soil covered with vegetation contains some remnants of the vegetable matter it has touched, together with a new assortment of micro-organisms; that which has flowed over or through beds of rock carries with it some portion of the mineral substance; while that which has percolated through clean soil, and has reached the underground reservoir which exists at a greater or less depth below the surface in most, if not all, parts of the earth, is generally found to have parted with nearly all but its mineral impurities.

The most natural conclusions to be arrived at from these remarks is that, if pure water is to be provided, it must be obtained from deep wells or from uninhabited or sparsely inhabited districts. These are not, however, the conclusions which a full examination of the subject will confirm. Nature is always steadily and persistently endeavouring to undo the evil which man effects; and, given a fair opportunity and reasonable time, she will bring back the most polluted water to a condition of healthful purity. It is man's duty to assist her in her efforts, not to combat them.

Deep-well water is generally free from, or contains but few, micro-organisms; and if it were possible to deliver it to the consumer in this condition, he could not ask for anything better. But just because it contains only a few organisms, it is exceedingly receptive of pollution. The bacilli ordinarily present in water are not injurious to health—in fact, may one not go further, and say their presence implies that they are beneficial? Moreover, if pathogenic germs be introduced into water in which the ordinary organisms exist, they are believed to rise in arms to destroy the intruders; but if they are in the minority, as they probably would be in deep-well water, it is they who are destroyed, while the pathogenic germs increase and multiply. Deep wells seldom yield more than 3 million gallons a day each, and generally considerably less. Therefore, if the water containing few organisms becomes polluted, its pollution is a serious matter. In the same manner, though not in the same degree, the incidental or casual pollution of a small stream is far more dangerous than in the case of a large river. The dilution in the latter case is much greater, there are fewer pathogenic organisms, and there is always a superabundance of the bacilli who war with the dangerous ones to put the latter in a minority. In the case of the casual pollution of a deep well, all the incoming water is pure, but contains few organisms to destroy the vitality of those which are dangerous to health. In a river the incoming water may or may not be pure, but there are other forces all tending towards purification—viz., sedimentation, vegetation, oxidation, and light; and the power of these must depend on the extent of the pollution, which may become so great as to destroy and nullify the forces tending to purification.

Some qualities of soft water affect lead pipes and produce lead-poisoning where such pipes are employed for distribution; and to prevent this effect, iron pipes, or pipes coated with tin, must be used. It is true that most people prefer soft water for washing, though it is doubtful if its cleansing powers are so great as with a harder water. Soft water is generally to be preferred for steam and manufacturing purposes. But, after all, the first consideration is health; and, though the quantity of water which is drunk may form but an infinitesimal part of the whole, it is this consideration, and this only, which should govern the selection of the supply.

The great polluting element is man, whether considered as an individual, or an aggregation of individuals, or as a manufacturer. Animal pollutions hold quite a secondary place. The most serious forms of pollution generally arise from the sewage works of towns or villages, many of which are so situated that the acquisition of land suitable for the satisfactory disposal of sewage and the production of a relatively pure effluent is difficult. The sewage farms or sewage-disposal works are seldom of sufficient extent to deal with more than the dry-weather flow; therefore in wet seasons the sewage is only very partially purified, for dry soil is the essence of the purifying process. Moreover, it is generally accepted that most of the cleansing takes place in the first few inches—decreasing with the depth, and ceasing, or nearly so, when the line of saturation is reached. Many shallow wells, and some deep ones, become contaminated from neglect of this knowledge. No chemical treatment of sewage, by itself, is sufficient to produce an effluent of satisfactory purity.

The author believes, as he stated in a paper communicated to the Congress of Hygiene held in Buda-Pesth in 1894, that the solution of the problem is to be found in some form of sand or similar filtration, probably accompanied by some method of breaking up the solids by biological treatment. A system of this character offers immense advantages in the disposal of the sewage of large towns, which might be broken up into sections of (say) 5000 inhabitants, each with its separate disposal works, the effluent from which might be turned into the nearest natural watercourse. It must, however, be worked as carefully as are the filters of a large water supply; and this is not possible in small villages, the sewage-disposal works of which are frequently in a very bad condition.

For the prevention of the pollution of water, and as a protection against it, there may be said to be three lines of defence. The first is the introduction, into an Act for the prevention of pollution, of clauses similar to sections 93 and 94 of the Thames Conservancy Act of 1894; the second is found in sedimentation and oxidation in storage reservoirs; and the third, in filtration through sand. The author quoted at length the sections above referred to; and on the other "lines of defence" he made the following remarks.

That sand filtration is a good and sufficient defence against the danger of the transmission of pathogenic germs to the consumer is very clearly stated in Dr. Percy Frankland's paper read before the Sanitary Congress at Newcastle-on-Tyne in 1896.* Dr. Frankland instances the case of Altona, and gives the results of the working of ten filter-beds attached to the water-works of that town during 18 days of the month of February, 1893. The raw river water drawn from the Elbe, which receives the untreated sewage of more than 4,000,000 persons, along with the more or less treated sewage of a further population of 1,750,000, contained on an average 28,667 bacteria per cubic centimetre, while the average number present in the filtered water was 90 per cubic centimetre—representing an average reduction of 99·69 per cent.

The discoveries of late years in the direction of bacteriological research have been so startling that there has been a tendency to magnify the use of biological investigation into the purity of water supplies at the expense of chemical examination. This is much to be deprecated. Bacteriological tests are useful as adjuncts to an examination under the microscope, and by chemical means; but alone they tell nothing of the history of the water, no more than that there are a certain number of bacteria, harmless or otherwise, at a particular moment. Carried further, bacteriology may prove the presence or absence of pathogenic bacteria; but it says nothing of the "why" of their presence or absence. Moreover, the presence of large numbers of bacteria in a sample of water may be conjectured to show that there is something in it, on which they feed, which would not be found in quite pure water; but the something may be nevertheless quite harmless.

Storage of water has a remarkable effect in reducing the number of bacteria contained in the raw material. In the Registrar-General's reports for 1896, there is some very instructive reading on this subject, and on the effects produced by filtration. Thus, after storage for four days, the average number of bacteria in raw river water was reduced by 58 per cent.; for 5·3 days, by 68 per cent.; for 5·6 days, by 80 per cent.; for 12 days, by 98 per cent.; for 17 days, by 83 per cent.; and for 28 days, by 96 per cent. Considering that the observations have reference to different storage systems—the actual time of storage varying with the time of year, and being something less than that quoted, and that the raw water is drawn from different rivers—the results obtained are remarkably consecutive, and serve to show what a wonderfully strong second line of defence may be provided by efficient storage; the third line being provided by the filter, which removes from 98 to 99 per cent. of the bacteria remaining in the water. In this manner, in the water of the Thames, containing some 24,107 microbes per cubic centimetre, after 12 days' storage only 508 bacteria per cubic centimetre were found, and after subsequent filtration only 34 microbes, or 99 86 per cent.

The figures given above are averages, and, like all similar figures, must be accepted with a certain amount of reserve; but

* See "JOURNAL," Vol. LXVIII., p. 757.

where it is found that the very worst results obtained record a removal of 77·14 per cent., the average minimum being 88·84 per cent., and the general average 99·60 per cent., it may be concluded that any departure from actual truth is trifling, and hat the protection afforded is eminently satisfactory. Because however a system of storage reservoirs, combined with efficient and carefully conducted sand filtration (filtration which is not carefully conducted may be very inefficient indeed), forms a strong defence against the introduction of disease through water supplies, the necessity for the protection of water against anything but the most accidental and fortuitous pollution must not be lost sight of. Streams and rivers need not, and ought not to be polluted; and all authorities should be compelled to do their duty in this respect. To this end it seems desirable that, for water supply and sanitary purposes, drainage areas of streams and rivers should be under the authority of boards or councils, whose duty it should be to provide for the conservation of the water, and rigidly enforce the law against pollution.

Discussion.

Mr. W. Whitaker, F.R.S., criticized the application of the word "impurities" to harmless as well as harmful constituents of water, and referred to the readiness with which deep-well water attracted and absorbed any impurities with which it came into contact. Alluding to the contamination of the Maidstone water, he remarked that it was lucky that a triple source of supply was available there, as had there been only one, and that had become contaminated, the result might have been much more serious. With regard to Lynn, he was able to state that the fault lay in the obstinate ignorance of the inhabitants themselves in neglecting the many warnings they had received for some years past. The Corporation officials had been quite alive to their duty in the matter, and were in no sense to blame for the condition of affairs at the present time. He thought it was a dreadful thing that the majority of the inhabitants of the town should have the power of victimizing the minority, simply to save their wretched rates. In the end, the rates were not saved—on the contrary, they were increased, because the work had to be done in a hurry. Referring to the London Water Supply, he thought the Thames Conservancy Board should have still larger powers with regard to the prevention of pollution. He considered that in all cases of river supplies the watershed should be taken as the unit of area, and said that if only this was done in the case of the Thames, the water supply of London would be thoroughly satisfactory.

Mr. A. M. Fowler thought that what they ought to strive after was more strict supervision by the local authorities. He instanced a case where collecting areas of water-works were liable to pollution by picnic parties resorting to them in large numbers at holiday seasons. He spoke very strongly in favour of soft water, as compared with hard; referring to the extreme wear and tear to which linen and cotton fabrics were subjected when washed in hard water. Statistics showed that there was little difference in the effect of hard or soft water supplies upon the health of the community. He considered that all surface waters ought to be filtered, and referred to improved designs of filters which could be cleansed by merely reversing the flow of water in them.

Mr. Bertram Blount disagreed with the author's remarks as to the liability of deep-well water to pollution, and thought that most engineers would prefer water from deep wells to that taken from rivers. He thought that hard water was, on the whole, better for domestic use than soft water. With regard to the powers of the Thames Conservancy, though these were generally used with great wisdom and effect, hardship occasionally arose. In one case the Conservators endeavoured to prevent the influx of an effluent into the Brent which was really of better quality than the water of the Brent itself. While agreeing with the author that a chemical examination of the water was more reliable than a merely bacteriological one, he considered that a bacteriological examination was a good check on the action of sand filters.

Dr. J. C. Thresh, the Medical Officer of Health to the Essex County Council, remarked that the serious outbreaks of typhoid fever at Maidstone and Lynn need not cause any general alarm, because he knew that in neither instance had proper precaution been taken to protect the water supply from pollution. Epidemics such as these were preventable; the only question to be considered in other cases was whether such precautions were being taken or not. He was bound to say that there were many cases in which the answer to this question must be in the negative. He criticized the author's objection to deep-well water; remarking that the pollution of such water was preventable, and it was unreasonable to object to it because Nature had filtered it so perfectly. He also disagreed with the author with regard to the filtering powers of subsoil. He quoted a case where the water in a well situated 10 feet from a cesspool, was completely purified in passing from the one to the other; also a similar instance where there were two cesspools within 30 feet of a well, and the water supply from the latter was perfectly satisfactory. To obtain a safe subsoil supply, all that was necessary was to properly protect a sufficient area around the source. He remarked that very few County Councils made use of the powers which they possessed in regard to this matter; and that if they all did so, they would in every case superintend both the water and the drainage areas within their district.

Mr. Percy Griffith, looking at the matter from the point of view of water supply, agreed with the author that the protection of the available water supplies in any district should precede works of drainage. He would even go farther, and say that in nine cases out of ten in rural districts a public system of drainage would be unnecessary if the water supply was properly protected from pollution. In such districts, the water supply could be carried out at a much less cost than drainage, and when provided would yield a revenue; whereas drainage works would not do so. The latter also required a much larger area of land. With regard to the author's apparent preference for surface waters, as compared with deep-well waters, he thought it was better to make use of the latter, which were so easily protected from contamination, rather than the former, which involved the elaborate precautions outlined in the paper. The author's preference for hard water as compared with soft, also tended to the same conclusion. The question of compensation to riparian owners also affected the cost of surface water supplies. He agreed with the three lines of defence the author laid down as being necessary to properly protect a surface water supply, but remarked that the cost of adopting all of them would often be prohibitive, especially in small towns.

Dr. S. Rideal also objected to the slur which the author had apparently cast upon deep-well waters. He thought it would be strange if a deep-well water supply was not properly protected from pollution. He did not believe in bacteriological examination of water at all; it was no criterion of the value of the water. The number of organisms per cubic centimetre capable of growing at blood heat, corresponded very fairly with the value of the water; but the number obtained on a gelatine plate gave no indication whatever of the suitableness of the water for domestic purposes.

Mr. Silcock, Borough Engineer of King's Lynn, said that up to the present time there had been about 428 cases of typhoid in his town and 43 deaths; but the epidemic was now practically over. The town was situated on the edge of an alluvial plain, known as the Valley of the Fens. The Borough of Lynn and the adjoining village of Gaywood, were supplied with water from a small stream which took its rise from chalk springs about seven miles due east of Lynn. One of the particular springs from which this river took its rise was almost immediately under a farmyard, another was under a churchyard, and the remaining springs were also contaminated in various ways. The intake was situated some ten miles down the stream, which took the whole drainage of a highly cultivated valley containing about 2000 inhabitants. The water was taken first into a small settling pond, and then into some tanks, which were dignified by the name of filters. Practically there was neither sedimentation, storage, nor filtration. He then described the position of the Lynn Town Council with reference to the water supply, as follows: Some five years ago an epidemic of typhoid broke out, which was traced to the water. On the instructions of the Council, he reported upon the matter. He designed a new means of supply, for which an Act of Parliament would have been necessary, and which therefore had to be submitted to the ratepayers. There was unfortunately a majority of one against the promotion of the Bill; and the scheme therefore had to be abandoned. At the present time, works were being carried out under a Provisional Order of the Local Government Board, and would be completed within a few months' time. Had the original scheme not been opposed, the works would have been finished a year ago, and the present epidemic would not have occurred. He described the circumstances to which the epidemic had been traced, and remarked upon the danger of taking water supplies from small streams, such as that which had caused the difficulty in this case. He also attached great importance to the question of storage, and considered that, had they had ten to fourteen days' supply in hand at the time, the pollution which then took place could have been avoided.

Mr. Perry F. Nursey said that he had himself investigated the circumstances of the water supply and the present epidemic at Lynn, and was prepared to have given the meeting an outline of the facts of the case similar to that furnished by Mr. Silcock. The strictures which Mr. Whitaker had passed upon the inhabitants of Lynn were in no way too strong. He, however, considered that the Town Council themselves were not altogether blameless in the matter, as their support of the original scheme referred to by Mr. Silcock had been anything but unanimous. They had got out of the difficulty by proceeding under a Provisional Order, instead of under an Act of Parliament; and the ratepayers in revenge had turned out of the Council one of its most prominent members, and one who had proved himself to be a true benefactor of the town.

Mr. C. E. Cassal said he considered the bacteriological examination of water a very dangerous and unreliable guide as to its actual purity and value for domestic purposes. He thought it would be a good thing if chemists and engineers would consult together, and endeavour to arrive at some *modus vivendi* on this question. In regard to the epidemics at Maidstone and King's Lynn, he described the present system by which such questions were submitted to the "greatest ignorance of the greatest number" as idiotic. These matters ought to be determined by some higher power than the majority of the ratepayers.

Lieut.-Col. A. S. Jones, V.C., said that sewage works should be dealt with as delicate pieces of machinery; but this was

practically never done. If such works received the attention advocated by Mr. Dibdin and Mr. Cameron, they would prove much more successful. He disagreed with the author's suggestion of sub-dividing drainage areas into such small sections as one to 5000 inhabitants. Had 20,000 or 30,000 been named, he would have cordially supported the suggestion.

Mr. S. NEWLYN, Secretary and Manager of the West Hampshire Water Company, described his works as deriving their water both from deep-well and river supplies. The wells, however, though carefully constructed, could not be depended upon, though the water after treatment was perfectly satisfactory. As regarded the river from which they drew a portion of their supply, the local authorities situated above the intake were allowed to discharge sewage into it, and could not be interfered with; and he considered that further legislation was required on this subject. Both sources of water supply were liable to contamination, and what was needed was some reliable means of treatment.

The discussion was closed by the reading of a communication from Dr. Sims Woodhead.

Mr. MIDDLETON, in reply, explained that his meaning with regard to deep-well water had been entirely misapprehended. All he had intended was to point out that if such water was contaminated, the contamination was likely to be more dangerous than in the case of river water. If well water was always filtered, it would, he believed, be preferable to river water. He could not agree with Dr. Thresh as to the filtering power of water-logged subsoil, and did not consider the case quoted sufficiently proved Dr. Thresh's contention. Mr. Whitaker was mistaken in saying that the Conservancy Board of the Thames had no power to deal with the whole of the watershed. By the Act of 1894, the whole of the area was put under their authority, except certain rivers (including the Brent) and a portion below Teddington. With regard to Mr. Fowler's opinion that local authorities ought to have charge of the source of water supply, he thought that in such cases the authority should purchase the works. He had suggested sub-dividing sewage schemes among districts containing a population of 5000 inhabitants, because the sewage from this number could be conveniently dealt with in a small area. He admitted that this plan could only be introduced in a tentative and gradual way; and in the Metropolis it would be probably more expensive to alter the present system than to leave it as it is.

Lighting by Reflection.—A novel system of electric lighting is being employed in the new library of the Columbia University, New York. In the centre of the hall there is suspended from the dome a large wooden globe about 7 feet in diameter, painted a light grey tint. On to it from the four corners of the building are projected beams of light from four powerful arc lamps concealed in the woodwork. The result is stated to be the diffusion of a beautifully soft light in all parts of the hall.

Fixing Leather to Metal.—In order to fix leather to metal, the *Machinenbauer* gives the following directions: Digest one part by weight of coarsely crushed gall-nuts with eight parts of distilled water for about six hours, and filter through linen. Then pour one part of cold water over a similar quantity of glue; leave it for 24 hours, and heat the whole, whereby a concentrated glue solution is obtained. Coat the leather with the warm gall-nut extract, put the glue on the roughened and warmed metal, lay the leather on it, press firmly, and allow to dry in the air. The leather cannot then be separated without tearing.

The Poisonous Action of Acetylene has been investigated by two Italian chemists named Mosso and Ottolenghi. Small quantities of acetylene are dangerous to animals. Inspiration of ½ litre of the pure gas poisons dogs in a few seconds, and powerful artificial respiration is needed to restore them. A 20 per cent. mixture of acetylene and air kills dogs in an hour or less; the disturbance to the system is so great in these slow actions, that the dogs often die after they have been brought into fresh air and have apparently recovered. Large quantities of the gas affect the respiration; smaller amounts produce irritation, followed by a period of paralysis and weakening of the heart and lungs.

The Petroleum Sources of the British Empire.—In the course of a lecture recently delivered at the Imperial Institute, Mr. Boverton Redwood, F.R.S., pointed out the localities in the British Empire where petroleum is already worked, or where there are indications of its occurrence in quantity. These include Scotland (where large quantities of mineral oils and solid paraffin have for years been obtained by the distillation of the shales of Midlothian), Burma and Assam, British North Borneo, Canada, Newfoundland, New South Wales, New Zealand, Barbados and Trinidad, and South Africa. The characteristic features of the oil-fields of India and Canada, and of those portions of the Empire in which promising indications of the existence of petroleum have already been met with, were shown by means of photographs. In Ontario there is a flourishing petroleum industry of long standing. The production of crude petroleum in that district amounts to more than 27,380,000 gallons annually. The shale deposits of New South Wales and the drilling operations which have resulted in the discovery of petroleum of high quality in New Zealand were mentioned.

REGISTER OF PATENTS.

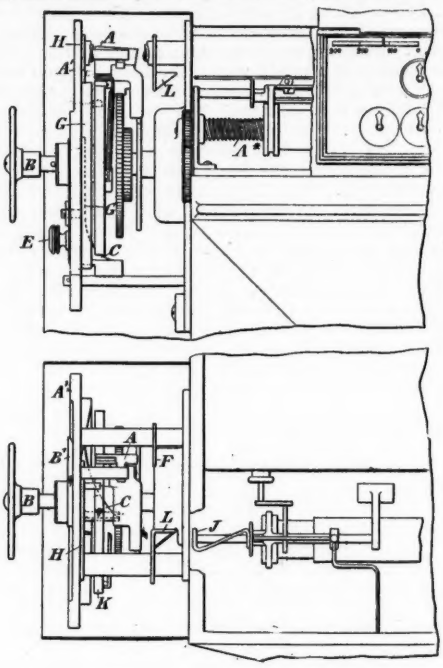
Controlling Gas-Valves by Electrical Energy.—Boardman, F. R., of Tottenham Court Road. No. 28,392; Dec. 11, 1896.

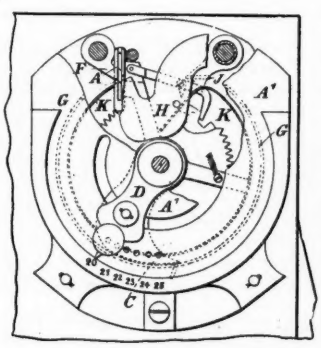
This apparatus for controlling gas-valves from a distance by electrical energy, consists in the combination of an opening coil, a closing coil, a control switch, an actuating source of electricity, and a relay source of electricity, with suitable opening and closing devices and circuit connections—all intended to be used in combination with the invention described in patent No. 17,958 of 1896, entitled "Improvements in or Connected with Burners for Use in Gas Lighting" (see "JOURNAL," Vol. LXX., p. 218).

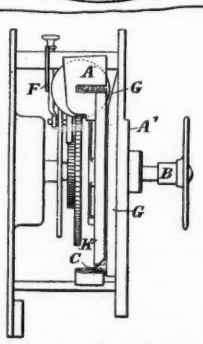
Prepayment Gas-Meters.—Cowan, W. & W. H., of Edinburgh. No. 28,828; Dec. 16, 1896.

This invention relates more particularly to the coin-actuating mechanism of prepayment gas-meters, as described in patents No. 13,200 of 1895 and No. 18,098 of 1896.

Under the present invention, the coin does not, as hitherto, fall by gravity from the plate carrier or pocket, but is forcibly ejected from it by a moveable and adjustable cam, which may be fixed in any desired position, so as to determine the quantity of gas to be supplied for each coin, and, when necessary, to vary the quantity as desired.







The illustration shows an elevation, a plan, an end elevation of a portion of a meter exhibiting one method of carrying out the present invention (the covers being removed for the sake of clearness), and an end elevation showing the coin in position within the pocket.

The pocket A is operated from the outside of the meter through the medium of the handle B; the entrance for the coin into the carrier being at the side of the operator—that is, in the line of the prepayment wheel shaft, and at right angles to the prepayment wheel. The cam C, which removes the coin from the carrier or pocket, forms part of an arm placed inside the frame at the front of the prepayment wheel; the arm being pivoted upon the shaft of the handle B, and connected to the arm D by a pin, which passes through a semicircular slot in the frame. It may, however, be pivoted in any other convenient way, so as to be capable of being moved round, and fixed at any of the holes in the frame by means of the thumbscrew E. As the holes are numbered and constitute a "graduated scale," while the arm D acts as a "pointer," the particular hole which is used for fixing the arm not only determines the position of the cam, but also indicates the quantity of gas which that particular position will allow to be supplied for the coin.

The pocket is formed with a slot or aperture, which permits the cam C to come in contact with, and gradually force out, the coin; the pocket

being prevented from travelling farther by reason of a stop upon the cam coming in contact with the face of the pocket. The handle only moves the shaft through a part of the circle forward, and has then to be turned back to the normal position. But, if desired, the operator may be so arranged that the handle and shaft will, on each occasion (and whatever the quantity of gas to be supplied for the coin), make a complete revolution, and thereby regain the normal position without any back movement. To effect this, the stop is removed from the cam, and the aperture in the pocket is made of sufficient size to admit of its passing clear of the cam when no coin is present, or when the coin has been discharged.

A stop F is provided at any convenient part of the frame, to prevent the coin from slipping sideways out of the pocket prior to the commencement of its travel. The teeth of the prepayment wheel may be cut to an angle of about 45°, in which case a simple form of guard may be employed, in order to keep the coin from moving outward from the carrier, during a small part of the lower division of the circle it describes. When the teeth of the prepayment wheel are cut in the ordinary "cog wheel" form, the base of the spaces are bevelled downwards towards the inside of the frame, so as to give an inclination in that direction, and prevent any tendency to go forward. But, as this would not prevent such a tendency when the coin was passing through the lower parts of the circle, a guard may be employed for the purpose, as already mentioned in connection with the 45° angled teeth. As shown, the upper part of the pocket is slightly angled, so that the coin, while the pocket occupies a position below the horizontal, will tend to come forward and rest upon the circular guard G.

In order to prevent the insertion of a coin after the coin-carrier has commenced its travel, and to prevent the possibility of straining or deranging the mechanism by actuating it after the full number of coins have been inserted, a shutter H is arranged to close the slot in the frame every time the handle is actuated, and be held closed after the insertion of all the coins by a rod J, which advances through the medium of a screwed rod or tube for actuating the valve or stop of the meter (as described in patent No. 21,108 of 1894), until a quantity of the gas at least equal to the amount supplied for a coin has been consumed. The slot is then again opened.

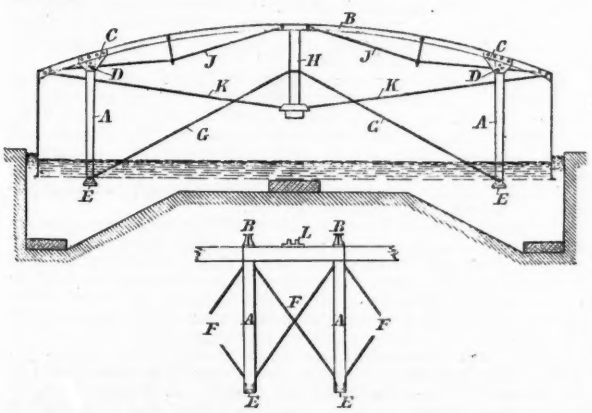
The shutter H (shaped as shown) is secured to a short pivoting tube, so that, when the coin-carrier is in its normal position, the shutter, by its own weight, occupies the position illustrated, and leaves the slot uncovered. Immediately, however, that the handle B is turned, a guard K, moving with the coin-carrier, and having a detent, acts upon the pin of the shutter which gradually rises and closes the slot—the guard keeping it in this position until the carrier is turned back. After the full amount of gas capable of being supplied at one time has been paid for, the rod J advances, and, acting on the cam L, raises the shutter, and prevents the mechanism being deranged.

Gas Motor Engine.—Mackenzie, J., and Carling, J., of Middlesbrough. No. 28,527; Dec. 14, 1896.

This invention relates to a motor or engine which, although mechanically adapted to be driven by steam or other fluid pressure, is more especially designed to employ motive power derived from gas or oil; the construction being substantially similar in principle to the "Otto" type of engine. The driving gear is, however, so arranged that in each cylinder the proper sequence of charging the cylinder, compressing the charge, firing, and exhausting, takes place during four successive strokes of the piston. But, inasmuch as the apparatus admits by its construction (say) of preferably four cylinders with their pistons and accessory parts being combined in one motor, and ignited in constant and regular succession, the motor is run under a constant and approximately uniform pressure, as distinguished from the intermittent pressure of an "Otto" engine; the requisite provision being made to convey the exhaust gases away from the cylinders by different passages to those provided for the admission of the live gases—this being claimed as absolutely essential to the proper working of a gas-engine constructed on the lines which embody this invention. A further advantage derived from the improvements is that such an engine can be made reversible.

Enlarging Gasholders.—Pease, E. L., and Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees. No. 1189; Jan. 16, 1897.

This invention consists "in effecting improvements in the method of, or means for, carrying out the operation of enlarging gasholders," by enabling the operation to be carried through without emptying the tank of water.



The operation, say the patentees, is at present carried out substantially in the following manner: In order to convert the top lift into an outer or intermediate lift, so that one or more lifts may be added to the holder to increase its capacity, the wall or outer plating of the lift is detached from the roof by cutting away the tee-bar principals or main-bars from their connections with the outer plating, and adjusting the length and points of connection of the corresponding tension-rods; leaving the roof framing inside the holder wholly unsupported by the wall of the lift, and transferring this duty to suitable framing erected for the purpose on the tank bottom—the water of the tank being removed, to enable the requisite framing to be erected.

A convenient method of erecting this framing without removing the water in the tank is shown in the illustration, which gives, in transverse sectional view, a single-lift gasholder and tank with framing erected, in accordance with the present invention, for the purpose of enlarging the holder; also, a corresponding part elevation of the framing bringing into view the bracing bars of two adjoining standards comprised in such framing—all of which are omitted in the top part except the two in line with the sectional view shown.

When the holder to be enlarged is emptied of gas, the props A of timber or timber and iron are introduced into the holder through a hole in the crown, and floated into their several positions, so that each prop can be adjustably attached at its outer end to a main bar or principal B of the roof framing by means of cleats C and a through bolt D. Cast-iron shoes E are fitted on to the lower end of each prop; the pin connection admitting of the shoes adjusting themselves to some extent to inequalities of the tank bottom. Air is then forced into the holder until the inner lift rises to its full height, in which position the props are suspended from their several connections in vertical positions clear of the water. They are now all connected together, as the posts of one structure, by means of trussing F from post to post, and by the tie-rods G radially connected with the centre post H.

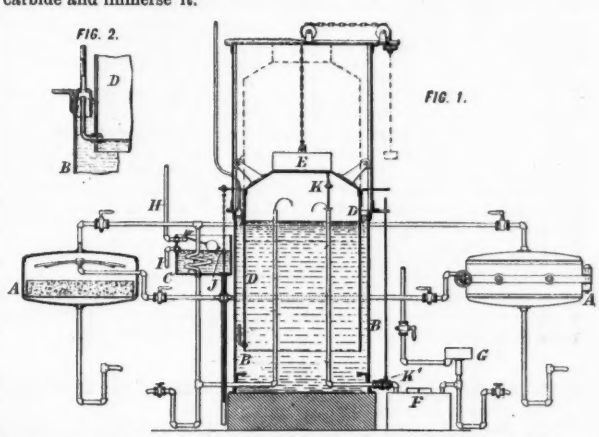
It is essential that the bracing-rods forming the trussing be adjustable as to length; also that in the cleats which connect the props with the roof-framing, arrangement is made for adjustment, so that, if it is found that one prop is grounding before another, this prop can slide up between its cleats, and the true level of the crown will not be interfered with through irregularities in the bottom of the tank. The air being withdrawn from the holder after this operation, the props A descend with the holder until they stand on the tank bottom as members of one structure, capable of taking the load of the roof-framing, which is transferred to them in the ordinary way by cutting away the main bars from the wall or outer plating and disconnecting the tension-rods J K provided to act as bow strings to the main bars. This is done after the bottom curb has been placed on rest-stones. The tension-rods are connected to the props, the cross framing of which is provided with shoes L wherever required to take intermediate main bars or principals. The final operation is then to detach the iron trussing from the holder. The roof-framing is now altogether detached from the holder, and supported on the props.

Incandescent Gas-Burner Pilot-Lights.—Bartlett, F. G., of Bristol. No. 1370; Jan. 19, 1897.

This invention consists in improvements upon patent No. 23,454 of 1896, according to which the lighting of a series of incandescent burners in a system is controlled from one bye-pass main cock or tap; each burner being provided with a pilot-light kept constantly supplied with gas. The present proposal is to provide in the pilot-light tube, or in a channel communicating with it, a valve so constructed and arranged as, when on its lower seat, to allow gas to descend above it and keep the pilot-light burning, but when gas is being fed to the burner, the valve rises to an upper seat and blocks the further passage beyond it.

Generating Acetylene Gas.—Mewburn, J. C.; a communication from A. M. Scott, of Woodstock, Canada. No. 1952; Jan. 25, 1897.

This is an arrangement of acetylene producer in which the water required to generate the gas is sprinkled over the carbide, rather than (as usual) for the carbide to drop into the water or the water to rise over the carbide and immerse it.



A are the carbide chambers capable of being closed hermetically against a slight pressure, and of being opened to charge with carbide, and for removing the residual lime. The chamber is shown open on one side, and closed by a door indicated at the right in fig. 1. Within the chamber is a tray of perforated metal, in which is placed the carbide, ordinarily in the form of lumps. Above the tray is arranged a sprinkler, constructed of small tubes radiating from a common hub, and of such lengths as to distribute the entering water with approximate uniformity over the entire area of the carbide. Water is admitted from any source of water that will convey it under a definite pressure—say, an elevated water supply reservoir C, from the bottom of which the pipe leads, terminating in the sprinkler. The bottom of the chamber A slopes toward an outlet; and to this is connected a trapped pipe constituting a hydraulic seal. Hence any portion of the water which is showered upon the carbide, and which is not immediately taken up, is discharged, so that no water is permitted to accumulate in the carbide chamber. From the top of the chamber

leads a gas-pipe to the holder B. It is formed into a condensing coil, conveniently located in the water-reservoir C.

The holder is constructed, as usual, with an outer vessel or tank containing water, and with a floating bell D, the weight of which must be such as to compress the gas to a less extent than the pressure upon the head of the water entering the carbide chamber. The holder is provided with means for resisting the rise of the bell above a given level; the resistance being sufficient to increase the pressure of the gas enough to equal or exceed that of the water entering the carbide chamber, and thereby to shut off the inflow of water before the bell can rise to a higher level. The preferred construction is a weight E, which is so connected as to be picked up by the bell in its ascent. The counterweight to E serves as a stop for limiting the downward movement of the weight, by being arranged to strike a fixed cross head when at the upper limit of its travel. In this way, the descent of the weight is arrested, and it is left suspended at this level.

From the holder, the gas passes to a dehydrator F, which is adapted to dry the gas as it passes through. A suitable dehydrator is said to be one containing alternated trays of calcium carbide. From the dehydrator, the gas is conducted to a governor or pressure-regulator G; and from this it flows at a uniform and reduced pressure to supply the burners.

The drawing shows the apparatus in full lines in the normal position; the floating bell D being in contact with the weight E, but not having lifted it. When starting operations, the chamber A having been supplied with carbide, the cocks adjacent to the chamber are opened, and water flows from the reservoir C to the sprinkler, and falls upon the carbide; some of the water passing into the trap, and sealing it. Acetylene gas is rapidly generated; and the steam which is carried over with it is condensed in the coil, and the water of condensation therefrom runs into the trap. The gas passes to the holder D, and flows through the outlet-pipe until the air in the pipes and holder has been displaced; whereupon the outlet may be closed, and the accumulating gas lifts the bell from its lowermost position until it bears against the weight E, and is stopped thereby. The bell remains stationary until the accumulating gas reaches a pressure corresponding to the weight of the bell, *plus* that of the weight; and as the pressure rises sufficiently to counterbalance that of the column of water, the entrance of water to the carbide chamber ceases, and the active generation of gas is discontinued. The generation of gas will, however, proceed at a slower rate by reason of the water held by capillarity in contact with the carbide and lime; and the gas thus generated increases the pressure in the holder until it lifts the bell and weight. The bell may rise to the extreme position indicated in the dotted lines; but in practice the capacity of the bell would be calculated in excess of the volume of gas that can be generated from the mere residue of water in contact with the carbide. As gas is consumed, the holder falls; the gas continuing under the greater pressure until the weight reaches its bottom limit, and becomes suspended by its chain or cord. The pressure may then fall until only sufficient to uphold the bell, whereupon, with a continued consumption in excess of any new generation of gas, the bell will further descend. The fall of pressure, however, before it will permit the further descent of the bell, admits water again into contact with the carbide; and a new generation of gas commences, which ordinarily will raise the pressure and check the inflow of water.

The water-reservoir C is supplied by a float-valve from a water-pipe H, and has an overflow-pipe I for carrying off any excess of water in case of leakage or derangement of the float-valve. There is a valve J to close the outlet from the reservoir, in case the bell of the holder falls nearly to its lowermost position. This valve is suspended from an arm projecting from the bell, and is guided by a long stem running down into a deep tube—the stem and tube being long enough to accommodate the whole range of vertical movement of the holder. The purpose of this valve is to prevent waste of water by flooding the carbide chamber A when the carbide has been consumed, and when consequently no more gas is generated and the pressure falls, permitting the bell D to descend. The valve J is arranged to close before the bell reaches its lowermost position, and consequently while a pressure corresponding to the weight of the bell is still maintained. When the holder falls to its lowest position, it is known that the carbide is exhausted, and consequently that the chamber A needs replenishing.

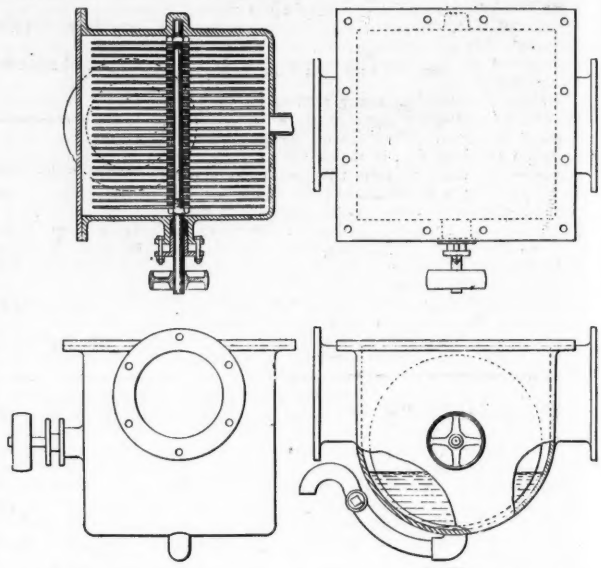
The invention provides means for guarding against neglect to promptly replenish the supply of carbide after it becomes exhausted. The bell D, after closing the water-valve J, will descend to the lower limit of its movement, where its weight is borne by stops suitably arranged; and if the consumption of gas continues, its pressure falls and the lights at the burners go out. There is liability, however, that some remnant of undecomposed carbide may undergo decomposition by reason of residual moisture, and thereby maintain a slow generation of gas which would pass to the burners. To effectually prevent this, at or before the time the floating bell reaches its lowest position, it operates a valve or seal, or some equivalent device for cutting off the outflow of gas. One way of accomplishing this is by suspending a valve K within the bell D, in such a position that, when the bell lowers to or near its bottom position, the valve shall seat itself upon the upper end of the gas outlet-pipe.

Enriching Coal Gas.—Whiteley, R. H., and Ellis, W., of Chesterfield. No. 16,890; July 16, 1897.

This invention relates to "a simple method of enriching coal gas by means of tar;" the object being "to extract from the tar as large a quantity of the light hydrocarbons which it contains as possible, and to add those light hydrocarbons to the gas before it passes to the gasholder."

The patentees say: "Our invention consists in breaking up the tar into spray, or otherwise dividing it in such a manner as to make the tar present a large surface to the gas passing over it. We preferably deal with the tar while it is still in the hot state, but we may also heat the tar after it has been collected and cooled. According to one method, we interpose in the foul gas main leading from the hydraulic main one or more mechanical agitators or stirrers, rotated at a speed sufficient to break up the tar which is still liquid and hot into fine spray, or to cause the tar to expose a large surface for the evaporation of its light hydrocarbons. The gas is therefore thoroughly brought into contact with every particle of tar before it reaches the condensers; and it thus carries away a large proportion of the light hydrocarbons, which greatly increase its illuminating power, and also, to some extent, its volume."

Two sheets of drawings illustrate the method proposed for carrying out the invention. One (reproduced) gives a plan of the agitator or stirrer, a section, an end elevation, and a side elevation. The second sheet is an elevation of a retort-house, showing the arrangement of the hydraulic main and connection to the condensers through the agitator, which is placed under the retort-house floor.



The agitator preferred consists of a long spindle carrying a considerable number of thin sheet-iron discs bolted upon it, but so spaced as to leave room for the passage of the gas between the different plates. The discs, with their spindle, are contained within a metal casing D, so devised that the inlet from the hydraulic main passes in at one side, and the outlet to the condensers at the other. The gas thus flows between the sheet-iron discs or plates, and becomes impregnated with the fine tar spray, and "so carries off from that spray the volatile hydrocarbons, or other matters of a volatile nature, which are capable of increasing its illuminating power." The patentees say they do not confine themselves to any particular type of agitator; and in some instances they do not rotate the discs fast enough to produce spray. In that case, they "rely upon the extended surfaces exposed to the gas," because the discs dip into the hot liquid tar E, and carry a fresh portion of the tar up at each revolution. The tar is kept at a fixed level in the agitator by an overflow-pipe F. In some cases, the ordinary exhauster performs the functions of both exhauster and enricher, by placing the exhauster upon the foul gas main between the hydraulic main and the condensers; and thus the exhauster, in addition to drawing away the gas from the retorts, and forcing it through the condensers, "beats up the tar, and causes the gas to carry away from it a large proportion of its contained hydrocarbon."

The claims for the invention are: (1) The method of, and process for, enriching coal gas by causing it to come into contact with the hot or heated tar from the hydraulic main in such a manner that the gas will take up the more volatile hydrocarbons and other carbonaceous bodies from the tar. (2) In combination with the process claimed in claim 1, the agitator or sprayer for causing the tar to come in contact with the gas.

Incandescible Gas-Mantles.—Voelker, W. L., of New Jersey, U.S.A. No. 22,625; Oct. 2, 1897.

This invention relates to a process for producing a very intimate union, in incandescible materials of the oxides of magnesium and calcium. The patentee claims to have found that "a material produced by the union of the oxides of magnesium and calcium has a high incandescent power and great durability;" and the present invention relates to a process for the manufacture of the material. No mere mechanical method—such as grinding the oxides—is said to produce a sufficiently intimate union, even with the addition of fusion after the grinding, and without the aid of chemical re-agents. The present process resorts to the action of chemical re-agents as one step, whereby "the molecules of the oxides of the two minerals are finally brought together in a most intimate arrangement and union."

Essentially the process consists in treating the oxides of calcium and magnesium together, with any suitable acid which will produce magnesium and calcium salts that can be afterwards decomposed back to the oxides; and then reducing such salts to the oxides. The oxides are then heated together by intense heat (as the electric arc), in a suitable furnace; the result being "a most intimate and durable combination of the two oxides." Nitric, hydrochloric, or sulphuric acid may be used to produce the salts; but nitric acid is preferred.

Equal parts by weight of the oxides of calcium and magnesium are reduced to the finest practicable powder by grinding in porcelain mills or mortars, either together or separately, and then intimately mixed and reground—the object being "to produce the most thorough intermixture of the powdered oxides practicable." The powdered and mixed oxides are next dissolved in nitric acid, to which a trace of chromic acid may be added, if it is desired to give a ruddy tinge to the light; and the solution is then evaporated by heat to the point of decomposition. At this stage of the process, the oxides are converted into nitrates; and by experience it is found that during this solution and decomposition, the minerals are brought into a very intimate union. The evaporation is continued until the solution is reduced to a waxlike consistency. The mass is then transferred to a magnesium or calcium crucible, heated to a bright red heat, and kept at this temperature for some time. For small amounts of material, the heating should be continued for about an hour for every pound of the material; for larger quantities, the heating

can be proportionally somewhat shortened. During this step, all the nitrates are decomposed and reconverted into oxides of magnesium and calcium; and during this step again, the intimate union of the oxides is promoted. Upon the completion of the decomposition, the mass is transferred to a crucible and heated to the point of fusion. It is preferably kept in a molten condition for some little time, to facilitate the still further intimate union of the oxides. The molten mass is then allowed to cool—forming a cake which can be ground up and treated for producing filaments, or the molten material can be run into moulds and cast into sticks, from which filaments can be drawn by heating the ends of the sticks sufficiently to soften them, and drawing them out just as glass is spun; and these filaments can be spun together to form a thread which can then be knitted into hoods or mantles.

Incandescible Gas-Mantles.—Voelker, W. L., of New Jersey, U.S.A. No. 22,626; Oct. 2, 1897.

According to this invention, the combustible thread or carrier for the decomposable salts which form the finished mantle is first carefully cleansed of impurities, dried, shrunk, and knitted into long tubes. These tubes are then saturated with a 25 per cent. solution of commercial thorium nitrate or other salt, the oxide of which will emit white light when heated to incandescence. After the saturation, the tubes are well drained of surplus solution; then transferred to a centrifugal drier; the balance of the moisture removed from them; and finally carefully dried at a temperature of about 120° Fahr. The tubes are then cut in pieces of suitable length to form mantles in the usual way. The framework or skeleton is next dipped in an alcoholic solution of the combined nitrates of calcium and magnesium; the solution being formed by decomposing combined oxide of calcium and magnesium in nitric acid, and using one part by weight of the dry salt (nitrate) to three parts of alcohol to form the alcoholic solution. After thus dipping, the framework is again burnt off over a bunsen flame; the nitrate of calcium and magnesium being thereby decomposed to the combined oxide of calcium and magnesium. The result is "a mantle composed of a mineral oxide framework completely covered with, or embedded in, a coating of combined oxide of calcium and magnesium." For certain uses, the patentee gives a second, and even a third, coat of material with good results; the richness and depth of the light increasing with these additional coatings. Besides this, the coating of calcium and magnesium is said to greatly increase "the strength, hardness, and durability of the mantles, so that they can be handled with only ordinary care without injury."

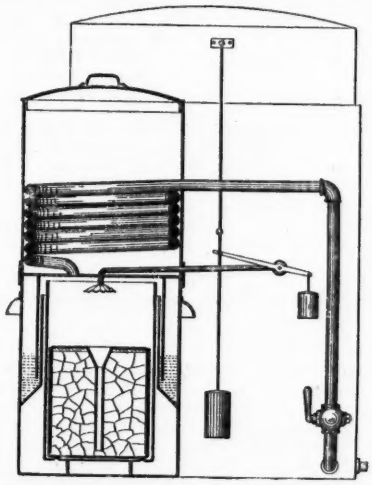
After the mantles have been made as described, they may be dipped in a coating composed of alcohol, ether, photoxylin (a chemically pure soluble cotton), celluloid solution, and excess of camphor, or covered with any other suitable coating.

Gas Water-Heaters, partly applicable to Pilot-Light Gas-Burners.—Buerkle, A., of Allegheny, Penn., U.S.A. No. 23,491; Oct. 12, 1897.

This improvement in water-heaters consists in the combination of (1) a cylinder; (2) an inlet supply-pipe passing to one side of its ends; (3) an outlet-pipe passing from its opposite end to a fluid receptacle heated by a gas-burner; (4) an outlet-pipe from this receptacle; (5) a piston adapted to be shifted endwise in one direction within the cylinder, by the pressure of water upon it, when the outlet-pipe from the heated receptacle is opened, and in the opposite direction, by a weight or spring, when the outlet-pipe is closed; (6) a passage formed through the piston; (7) a valve normally closing this passage, but restrained from moving with the piston when the piston is moved endwise on the opening of the outlet-pipe, so that the passage through the piston is then opened, and water flows through it to the heater and to its outlet-pipe; and (8) a valve for regulating the flow of gas to the burner, opened and closed by the movement of the piston.

Acetylene Gas Generators.—Buffington, L. S., of Minneapolis, Minn., U.S.A. No. 23,802; Oct. 15, 1897.

This invention relates *inter alia* to an acetylene gas generator consisting of a combination of an upper vessel containing water, and a condensing coil immersed therein; the vessel being provided with an adjustable needle-valve and with a cylinder extending down from and enclosing



a cup containing the carbide cartridge, while the outer vessel has its upper end detachably connected to the water-vessel, and its lower end adapted to contain a liquid seal.

As shown in the engraving, the generating vessel is made with an annular well containing the sealing liquid, into which the lower edge of a cylinder is immersed to form a gas-tight joint. The generator is removably secured to the upper vessel by a bayonet joint not shown. The gas is conducted from the generating chamber into the gasholder, first through a condensing coil in the water-vessel, and then through a valved pipe. Water is supplied to the generator through a small pipe terminating in a spraying device at the centre of the generating chamber. The cock in the water-pipe has on it a lever, having a weight on its one arm to close the cock; while the other arm is connected by a cord or chain to the moveable part of the gasholder. The cord or chain carries a weight and passes through a hole in the arm of the lever; but there is a lug or stop, which bears on the lever and opens the cock whenever the holder descends beyond a predetermined point. Thus the generating action is automatic.

Incandescent Gas Mantles.—Ottenbruch, H., of Coblentz, Germany. No. 24,815; Oct. 26, 1897.

This invention relates to an incandescence body or mantle for use with gas under pressure, and so constructed that it "is not liable to be broken or deformed by the action of such gas upon it."

The mantle is interwoven with platinum wires, for which purpose either single wires or those composed of several thinner wires are employed—such wires passing radially from the contracted upper portion of the mantle, and downward in a vertical direction. The number of wires used in each mantle depends upon the pressure of the gas and the candle power of the burner with which it is to be employed. In cases where the mantle is required to be especially strong, a fabric may be made from the platinum wires, and connected with the fabric of the incandescence body. For instance, "a platinum body woven to form a net may be covered with a mantle manufactured in the usual manner, or both nets may be woven directly together."

Safety-Devices for Water-Gas Producers.—Humphreys, A. C., and Glasgow, A. G., of Victoria Street, S.W., and New York. No. 24,943; Oct. 27, 1897.

In apparatus where there is an alternate production of water gas and fuel gas—as described in patent No. 23,904 of 1896—there is, say the patentees, some danger of forming an explosive mixture by the air-blast mixing with the water gas; and certain means were described in the specification for obviating this danger by interlocking the blast-valves, which control the admission of air to the various parts of the apparatus, with the valve through which the products of combustion are led away from the apparatus—usually termed the "take-off" or "stack" valve, owing to its being situated at the entrance of the stack.

In some cases, the inventors find it advantageous to be able to operate the generator blast-valve independently of the stack-valve; and the object of the present invention is to provide means whereby this can be done, while at the same time liability to explosions is avoided by interlocking the generator blast-valve with the oil-supply valve and with the gas-valves controlling the direction of make in the generator. The stack-valve is allowed to remain interlocked with the other blast-valves of the apparatus; and the stack-valve may also be interlocked with the steam or oil-supply valves, or both. The steam-valve in this latter case may be arranged in such a manner that it can, if desired, be disengaged and operated by hand—such disengagement, however, requiring the performance of a series of deliberate operations, which preclude any possibility of its being affected inadvertently.

APPLICATIONS FOR LETTERS PATENT.

29,982.—Drake, H., "Incandescent gas-light burners." Dec. 18.
29,990.—Henderson, D., "Gas reversing valves for furnaces, &c." Dec. 18.
30,045.—Thiersant, H. de, and Coulson, W. A., "Acetylene gas producer." Dec. 20.
30,078.—Clarkson, J. M., "Contrivance applicable to gas or the like stoves for the purpose of heating plates or dishes." Dec. 20.
30,080.—Brand, M., "Coke-ovens." Dec. 20.
30,094. Chandler, S., jun., and Chandler, J., "Gas leakage meters, as applied to buildings." Dec. 20.
30,106.—Chauveau, G. V. L., "Internal combustion engines." Dec. 20.
30,112.—Albert, G. L., Count de Hamel de Manin, "Incandescence bodies for illuminating purposes." Dec. 20.
30,114.—Boudeville, A., "Gas or oil motors." Dec. 20.
30,121.—Fricker, G. C., "Controlling the supply of gas to burners." Dec. 20.
30,132.—Billing, C. E., "Gas-burners." Dec. 20.
30,145.—Boult, A. J., "Incandescent bodies for illuminating purposes." A communication from the Chemische Fabrik von Max Jasper. Dec. 20.
30,267.—Smith, W., "Driving by means of a wheel or disc and the aid of liquids, air, vapour, or gas." Dec. 22.
30,272.—Baughan, W. H., "Generating, cooling, and storing acetylene gas." Dec. 22.
30,288.—Foulds, T., and Haworth, W., "Generation and storage of acetylene gas." Dec. 22.
30,324.—Kramers, J. C. H., and Kiderlen, A. E., "Enriching generator gas." Dec. 22.
30,354.—Kemp, E., "Cutting off the gas supply from buildings upon the outbreak of fire." Dec. 22.
30,422.—Forbes, Sir C. S., "Acetylene lamps." Dec. 23.
30,423.—Forbes, Sir C. S., "Condensers." Dec. 23.
30,424.—Forbes, Sir C. S., "Generating acetylene gas." Dec. 23.
30,425.—Forbes, Sir C. S., "Condensers." Dec. 23.
30,437.—Jürgens, J. F. C., "Gas-cocks having igniting tubes." Dec. 23.
30,475.—Legge, J. St. C., and Cooper, A. S., "Generator for acetylene gas." Dec. 24.
30,480.—Reisert, H., "Water-meters." Dec. 24.
30,504.—Edge, J. S., and Hall-Wright, J., "Gasaliers." Dec. 24.
30,507.—Badon, M. J., "Boring artesian wells." Dec. 24.
30,538.—Sellar, W. C., "Production of cyanides or cyanogen compounds." Dec. 24.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Tyranny of Trade Unions.

SIR,—Happily the Engineers' Federation are making the stand that, as the "Newcastle Daily Chronicle"—Joseph Cowen's paper—said a few days ago, is "The Moscow of the New Unionism." This was the heading of the leading article in which they say: "The most important thing that the six months' struggle has settled may already be pointed out with absolute certainty. Among other things, it has emphatically settled the 'New' Unionism. The movement that began with the dockers' victory in 1889 has ended with the engineers' *débâcle* of 1897." I quote this as introductory to the remarks I have to offer on the letter in the "JOURNAL" for Dec. 21, from "A Manager," on the action of Trade Unions in relation to gas-fitting. It is true that, in fitting up large houses or premises, where there is sufficient work a carpenter is often employed to assist the gas-fitters; but in all ordinary and simple cases gas-fitters have done what little work may have been necessary in taking up floor-boards, fixing wood blocks, &c., and making good the plastering. The answer to any Trade Society objecting should, of course, be to tell them the gas-fitters will continue to do all such work as they are capable of doing in the future as in the past.

As to the other letters in the "JOURNAL" relating to the claim of the Plumbers' Union to do the gas-fitting of the theatre at Nottingham, which is an entirely new departure, it seems that the ironmongers are thereby invited to imitate the engineers, and federate in their own defence. It is high time this overbearing tyranny of the Trade Unions was stopped; and now is the time to do it, with the example of the Federated Engineers to show how. It is a new thing, so far as I know, for the question to be raised about gas-fitters, and it should be nipped in the bud. Otherwise, if yielded to, it is sure to spread, as a similar practice has done in the building trades, of which the following is a typical instance: About three years ago some new work was going on at a London gas-works on which a number of bricklayers were employed. One morning the Engineer in charge under the Chief Constructing Engineer, on arriving at the works, was told that all his men had stopped work; and on asking the reason they said that in another part of the works some labourers had been set to dress or trim the rough surface of an old wall where part had been pulled down and part left standing. The complaint of the bricklayers was that these labourers were using bricklayers' tools—hammers and chisels. The Engineer in charge had not authority to act as I am sure he would have liked to do, but had to take off the labourers, when the bricklayers at once resumed work. He, however, met them in this way: He had some chisel-ended pickaxes made, and again set the labourers to work on the same job. The bricklayers did not again object, because they recognized the pickaxe as a labourer's tool.

In all these cases the objecting workmen should be told to take their tools and themselves at once off the premises. Let all employers take heart from the engineers, and maintain their natural right to employ what men they please, and set them to any work which in the opinion of the employer they can do. Sooner or later they must take this course, or the tyranny of the Trade Unions will overwhelm them and their workmen. The gas industry is at the present time under a deep debt of obligation to the Engineers' Federation; for had it not been for the admirable stand they have made there is no doubt our old friends of the Gas Workers' Union would have been very active for mischief this winter. They have, however, had their hands full in providing for the large number of their members out of work through the strike and lock-out. The Engineers' Federation has, therefore, a strong claim on gas undertakings for support in every possible way.

GEORGE LIVESEY.

Dec. 28, 1897.

The Extinction of Gas Companies.

SIR,—Though I regret that my letter on the above subject, which appeared in the "JOURNAL" on Dec. 7, has not led to a more general discussion, I am not greatly surprised. This is the busiest part of the year to all gas companies' officials, leaving them no leisure to attend to anything outside their ordinary daily duties; nevertheless I may be permitted to hope that the views which have been expressed, and the information which has been given, will have been carefully pondered by a good many of your readers.

And now with reference to Mr. Henry Tobey's question. He writes: "I have not discovered any instance in which a company possessing statutory powers, and conducting their business in accordance with them—faithfully carrying out their obligations, and treating their customers liberally—and not being 'in Parliament,' have, upon the application of the local authority, had their Charter cancelled and their business transferred to such authority. I am in search of such a precedent, and shall be under an obligation to 'A Gas Secretary' or anyone else who can refer me to one." Well, I may admit at once that, so far as a *statutory* gas or water company is concerned, I cannot refer him to such a case—some more or less plausible excuse has always been forthcoming. I may, however, refer Mr. Tobey to the following, which are the leading cases usually relied upon by the promoters of compulsory Bills: Stockton and Middlesbrough Water in 1876 and Cheltenham Water in 1878. But in each of these cases "parliamentary misconduct" was proved. The Company had been unable or unwilling to fulfil their obligations.

A few years later came the Sheffield case (water). This was uncommonly near being a compulsory purchase. Lord Derby, the Chairman, said the Committee did not impute any misconduct to the Company, but they were of opinion that it was of public importance that the water supply should be in the hands of the Corporation. The Company took the hint, came to terms, and so saved the Committee from having to give a decision. Then there was the case of Rotherham Gas in 1874. In that instance the excuse was that the Company had supplied bad gas.

In 1892-3 came the Ilkley case; and this is one which will not give Mr. Tobey any comfort. Some complaint was made of certain transactions which it was alleged had been unfair to the consumers, and it was also stated that there had been bad bookkeeping. The House of Commons passed the Bill; but when it came before the Committee of the House of Lords, the Company, seeing how things were going, made a virtue of what they believed to be a necessity, and agreed to sell.

Of the non-statutory cases, Matlock Bath in 1896 is probably the strongest. In that instance the Committee stated expressly that nothing could be alleged against the Company; nevertheless, and in spite of the most strenuous resistance, the Bill passed both Houses. Here I do not think a clear case of expediency in the public interest was made out.

We may assume that the Filey Urban District Council have been advised that they may rely upon getting their Bill through. Parliamentary Counsel, Engineers, and Agents—that busy and prosperous body of men—will have combined to give the Council the needful encouragement. Well, if I may say so, I hope the Company will fight hard, and in the end come off victorious. They will do so if the Committees act as fairly as they did in several cases last session.

A GAS SECRETARY.

Dec. 30, 1897.

Gaseous Firing.

SIR,—Mr. Carpenter, in his letter in the "JOURNAL" for the 21st ult., seems to have misunderstood some of my remarks. In speaking of a set of retorts with a producer underneath, I mean a setting with the front of the producer in a line with the mouthpiece. This would not be in the way of the coke-waggon rails.

With reference to the machine-stoking point of view, it will greatly depend on the design of the settings how much this interferes with the charging and drawing of the retorts. For instance, in a 21-feet setting, with the retorts blocked in the middle and a producer at one side only, there can be no hindrance on the opposite side at all, and the hindrance on the firing side will depend greatly upon the way in which the producers are fed, and the amount of fuel they require. There must be more labour needed in moving the coke from the retort-house and charging the outside producer than in drawing straight into the producer under the setting. Then again, in using cold coke, which has been quenched with water, there must be a lot of steam generated, which is of no use to the setting.

Mr. Carpenter mentioned in one of his letters something about using breeze for firing. Perhaps he could define this article. There seems to be a great difference of opinion as to what breeze should be composed of. If Mr. Carpenter means very small coke and coke dust, I think if this is obtained from an unscreened coal there might be something else in it which it would be very much better not to use, because it would only have to be removed when it gets as far as the firebars.

It is quite true I mentioned a larger size of retort than Mr. Carpenter. But I did this to point out that there was plenty of room for the larger retorts in his setting, and that they would require no more fuel than the smaller size.

I do not agree with Mr. Carpenter that the amount of coal to be carbonized in a retort is as much as it will hold. This sort of thing might increase the make per mouthpiece, but it would decrease the make per ton.

PERCY H. FLETCHER.

Evesham, Jan. 1, 1898.

A "Country Gas Manager" writes in reference to this subject that he has at work at his place three beds of six retorts (singles) heated as Mr. Carpenter described in his paper at the Southern District Association, except that two beds get their heat from one producer. He obtains good and regular heats, with the exception of the two bottom retorts in each bed, which do not carbonize so much coal as the others. He has no trouble from the gas or air nostrils becoming blocked; but when making 5500 cubic feet per mouthpiece per 24 hours it requires an extra man to keep open the ascension-pipes, which with the dip-pipes are 5 inches in diameter. The front walls are 9 inches thick. The hydraulic main is free from thick tar, and an exhauster is in use. The coal used is best Durham; and the fuel account amounts to about 27 per cent. of the coke. He is at a loss to understand the reason for such continuous stoppages in the ascension-pipes.

Horizontal Bearings for Inclined Retorts.

SIR,—The publication in your last issue of a patent for inclined retorts in the names of Mr. W. D. Cliff and the Leeds Fire-Clay Company recalls a matter of not very ancient history, which may be of some interest to those who attach importance to horizontal bearings for such retorts.

In the "JOURNAL" for May 17, 1892, I called attention to the recent publication of a patent taken out by A. Klönne and F. Bredel; stating that, so far as this related to "an improved method of supporting retorts which are set at an angle to the horizontal line," it had been anticipated by my patent No. 5078 of 1890. This view was subsequently upheld by the Comptroller-General of Patents, a copy of whose decision I am enclosing.

Having regard to the terms of this decision, it does not appear to be easy to avoid the conclusion that this patent of Mr. Cliff's, like the earlier one of Klönne and Bredel, has been pretty fully anticipated. At all events, every one is free to apply horizontal bearings to inclined retorts in the manner set forth in my patent No. 5078, which has been allowed to lapse.

CHARLES HUNT.

Birmingham, Dec. 30, 1897.

[ENCLOSURE.]

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

In the Matter of an Application by ALFRED JULIUS BOULT *for Letters Patent No.* 9310 *of* 1891 *and of the Opposition thereto by* CHARLES HUNT.

DECISION.

The opposition is directed to that part of the invention illustrated more particularly in figs. 3 and 4 and claimed in claim 2, which consists in forming on inclined retorts circumferential rings having horizontal supporting surfaces; and the opposition is on the ground that the invention has been patented on opponent's application 5078/90.

According to opponent's specification, inclined retorts are formed on "either or both of the upper and lower exterior surfaces" (p. 2, line 37) with snugs having horizontal supporting surfaces. The object in each case is admittedly the same; and the only difference between the two arrangements

appears to be that in the applicant's case the snugs are continued round the retorts, so as to form rings. This difference does not, in my opinion, constitute a difference as to invention; and I find that, as regards the subject-matter of claim 2, the invention has been patented as alleged.

I shall therefore require applicant to excise claim 2, and, having regard to his claim 3, to insert a reference in the preamble to the claim, after the words "I declare that," substantially to the following effect: "I am aware that it has been previously proposed to form inclined retorts with snugs having horizontal supporting surfaces, and I lay no general claim to the arrangement for this purpose hereinbefore described, but," &c.

When the applicant has consented to the amendment of his specification as before stated, I shall proceed to seal a patent in due course.

Dated this 6th day of August, 1892.

(Signed) H. READER LACK, Comptroller-General.

The Collection of Gas Accounts.

Mr. R. G. Shadbolt writes that he has noted Mr. Brearley's remarks in the "JOURNAL" for the 21st ult.; but, as others may have something to say on the subject, he purposes giving them an opportunity of doing so before again dealing therewith in our columns.

LEGAL INTELLIGENCE.

Unlawfully Laying and Connecting a Gas-Pipe.

George Rich, a labourer, of Nailsworth, was charged last Thursday, at the local Police Court, with unlawfully laying a pipe communicating with a certain other pipe belonging to the Stroud Gas Company, without their consent. Mr. L. D. Winterbotham prosecuted. Albert Drysdale, an employee of the Company, deposed that on Dec. 3 he noticed gas burning in defendant's bedroom, and he called the attention of a police sergeant to it. He had also seen the gas burning in defendant's house on several nights since. He reported the matter to the Manager of the Company (Mr. G. Cutler), who instructed him to disconnect the pipe from the main. How long this illegal consumption of gas had been going on, he did not know. The Bench considered the case a serious one, and fined defendant £2, including costs, or fourteen days without hard labour.

An Ingenious Method of Preventing the Registration of Gas Consumed.

At the Newcastle Police Court last Thursday, an elderly man named Joseph Renwick, described as a lodging-house keeper, was summoned on a charge, that, "between Aug. 26 and Nov. 11, he did fradulently prevent a certain meter, the property of the Newcastle and Gateshead Gas Company, let for hire to him, from duly registering the quantity of gas supplied." Mr. Edward Clarke, who appeared for the Company, drew the Magistrates' attention to the Company's Private Act of 1864, under which the prosecution was made, and said that if the Company had taken his advice, they would have charged the defendant with larceny of gas, rather than under their own Act; for, in his opinion, it was a most shocking case of fraud. In their generosity, however, they had decided to proceed as indicated, as it was the first case of the kind. The maximum penalty was £5. Proceeding with the details of the case, he said that, during the time the Company had had dealings with Renwick, the latter had had four meters, all of which had been more or less suspicious. The one to which the charge had reference, had been the means of the perpetration of a most ingenious system of fraud. When the meter was fixed, care was taken by the Company to put in an absolutely new one, so that no doubt might be raised as to whether or not there had been any tampering with it. In the present case, the allegation was that a hole had been bored in the bellows, thus allowing the gas to be used without the index being affected. Unfortunately, however, for the complete success of the experiment, the hole had been made too large; and the result was that no registration whatever took place for three months. The first witness was Mr. Thomas Wadham, the Secretary of the Company, who stated that defendant's meter, between Aug. 26 and Sept. 10, registered 2200 cubic feet of gas; and from the latter date to Nov. 5, there was no further alteration of the index. Afterwards, when another meter was put in, the correct quantity used was registered. Andrew Wood spoke to fixing the defendant's meter, which he produced. After it had been removed and examined, it was found that a hole had been bored in the case, and also into the bellows—one opposite the other. The former had then been soldered over and painted. Renwick here protested that he did not know anything about a meter. William Stewart gave evidence to the effect that the hole in the bellows enabled 18 cubic feet of gas to pass into the pipes—the highest possible quantity—without registration. The defendant again asserted that he knew nothing about the meter; but the Bench showed their feeling in the matter by imposing a fine of £5 and costs.

Theft from a Prepayment Meter.

At the Lambeth Police Court, last Saturday, Joseph Heyburn, 18, described as a kitchen porter, was charged with stealing from a prepayment gas-meter, at 161, Neate Street, Camberwell, 8s., the money of the South Metropolitan Gas Company. William Knapp, inquiry officer to the Company, said he went that morning to the house in question, which was in the occupation of the prisoner's sister, and found that the gas-meter supplying the premises had been broken open, and 8s. taken from the money-box. The prisoner was present. Witness asked who had broken the meter open. The prisoner replied: "I did it. I broke it open with a bradawl." Witness said: "Eight shillings have been stolen from the meter." Prisoner replied: "I took the money, but I did not count it. It was somewhere about that amount. I broke it open on Monday last. I have been out of work for eight weeks, and being without money placed me in a funny position." The police-constable who took the accused into custody said he declared that he committed the robbery because he was out of work. Mr. Hopkins directed a remand.

MISCELLANEOUS NEWS.

BELFAST GAS AND WATER SUPPLY.

Annual Accounts.

The accounts of the Belfast Corporation Gas Department for the year ending June 30 last have been published. They show that the sale of gas, less discounts and bad debts, produced £131,829; public lighting, less cost of lighting and repairing lamps, £13,141; and residual products, £42,216. Some minor items made the total income £188,201. The expenditure came to £123,315, in which were included the following items (omitting shillings and pence): Coal (83,589 tons), £50,357; purification and sundries, including labour, £3927; salaries of Engineer and Assistant, £1495; carbonizing wages, £13,761; repairs and maintenance of works and plant, £7400; coal and coke used for steam boilers, £636; oil for carburetted water gas (1,561,763 gallons), £17,907; wages and fuel for carburetted water gas, £8226; repairs of carburetted water-gas plant, £503; salaries of chief inspector, inspectors, and clerks, in distribution department, £1945; repairs, maintenance, and renewal of main and service pipes, £1987; repairing, renewing, and refixing meters, £4099; rents, rates, and taxes, £5589; salaries of cashier, accountant, and clerks, &c., £2459; salaries of collectors, £1645; stationery and printing, £275; general establishment charges and incidental expenses, £868; audit fund, £52; law charges, £177; and the balance carried to net revenue account was £64,886.

At the last meeting of the Belfast City and District Water Commissioners, the Chairman of the Finance Committee (Mr. Dalzell) made his annual statement. He said that during the year they had received in rates £31,048, which was an increase of £1586; and by specials, £6174, which was an advance of £144. The supply by meter gave them £21,932, which was an addition of £1456. The sum received for building specials was £1696; ship-water, £867; and meter rents and sundries, £1055—all of which were advances on the previous year. The total increase for the twelvemonth was £3680. Dealing with the expenditure, Mr. Dalzell stated that interest and dividends, after deducting interest from the bank and dividends on investments, was £30,270; being an increase of £5046. The annuity and rent charge was the same—viz., £1200. Wages amounted to £3235, which was an increase of £314. This arose from the fact that they now employed more men, and had also increased the wages. Salaries came to £2366; and payments to rate collectors to £1821. Among other items, he said the maintenance of works at Oldpark, Woodburn, and Stoneyford cost £2772, as against £3794 in 1896, which was a difference of £1021 in favour of this year. Meter inspection and repairs cost £500, as compared with £423 in 1896; and on waste detection by meter £1007 was expended. Although there was an increase of £340 in the latter item, he confessed that he would like to see it even more. The saving effected by the present imperfect system was a million gallons of water per day. To bring in this quantity a capital outlay of £60,000 would be required, and this would cost for interest alone about £2400 per annum. Thus, besides preventing the water running to waste, for an outlay of £1007, they saved a useless loss of £2400 per annum. He hoped that before long the Commissioners would tackle the matter, and have a perfect system. Even if they had the Mourne water, there was no reason for waste; and this could only be prevented by the full development of the system. Rents and rates amounted to £3479, as compared with £4029 in 1896. Turning to the capital account, Mr. Dalzell said they began the year with a balance of £209,631 in the bank; and they had expended £149,704. In addition, they had paid off mortgages to the amount of £21,597, which left £38 330 in the bank on capital account. The expenditure of the year had been: On the Mourne scheme, £130,538; and other capital outlay, £19,165. The total sum expended on the Mourne scheme to date was £239,480. They would require £150,000 to meet the expenditure of the year; so that another issue of stock would be necessary. The last issue of 3 per cent. stock—£250,000—was taken up in a few hours at a premium of £5 per £100; and by this transaction the Committee netted for the ratepayers a clear profit of £12,500. This showed clearly the confidence placed by investors in the Trust. It was a gratification to the Commissioners that they had been able to carry out the great Mourne scheme so far without any additional taxation; and he had every confidence in stating that they would be able to complete the work without increasing the present low rate of 1s. in the £1. The report, which was considered of a very gratifying character, was adopted.

COVENTRY CORPORATION GAS SUPPLY.

The Proposed New Works.

At the last Meeting of the Coventry City Council, the Gas Committee presented a report on the subject of the Bill of which they had previously been authorized to give notice, to sanction the acquisition of land for the erection of gas-works. The Bill proposes to confer borrowing powers up to £250,000 to cover the cost of the land and works, and the improvement and extension of the gas undertaking generally; also to supply gas in the parish of Exhall, and to supply gas in bulk to any local authority or person, whether within or beyond the ordinary limits. It is proposed to amend the provisions of the Gas Acts of the Corporation with respect to the reserve fund. This fund is at present limited to £5000, and is applicable "to answer any deficiency at any time happening in the income of the Corporation from their gas undertaking, or to meet any extraordinary claim or demand at any time arising against the Corporation in respect of the undertaking." The Bill empowers the Corporation to increase the fund to an amount not exceeding one-fifth of their aggregate capital expenditure upon the gas undertaking; and it also allows the fund to be applied in payment of the cost of renewing the works or mains, in addition to the purposes for which it is at present applicable. Further amendments are proposed to be made by the Bill as follows: Consumers are to give 24 hours' notice in writing of their intention to quit any premises supplied by meter; surplus revenue is to be applicable in extending and improving the works; and more elaborate

provisions are made with respect to the sinking fund. The Committee recommended that the Bill should be promoted.

Alderman ANDREWS, in moving the adoption of the report, said he had on a previous occasion gone so fully into the policy of the Gas Committee—past, present, and future—that he need not go over the ground again. The Committee had been authorized to prepare a Bill; and it was now brought forward for the Council's consideration. Having dealt with some of the provisions contained in the Bill, he went on to say, with regard to the amount of capital it was proposed to borrow, that it gave them power to raise £250,000. He should have been satisfied if the amount had been less; but they were advised by those who had prepared the Bill, that they must lay down some principle or method of fixing the sum they would require, and that the best plan would be to take a certain number of years, gauge the consumption of gas in that period, apply the principle to the future, and then estimate the amount of capital that would be needed. This had been estimated in the following manner: Ten years ago, in 1886, the quantity of gas manufactured was 182 million cubic feet; last year it reached 504 millions. Therefore in ten years the consumption had increased by 2¾ times. If they applied this principle to another ten years, they would be making 1300 million cubic feet of gas per annum in 1907. Their Engineer (Mr. George Winstanley) had made an estimate of the capital that would be required in ten years for the production of this quantity of gas; and he came to the conclusion that £250,000 would be the figure. They asked in the Bill that powers should be granted them to borrow this sum; but he did not know whether the Council would get them. The application did not bind them to anything; all they wanted was to get the Bill through, pay for the land, and spend the capital from year to year as needed. He might point out that he believed the expenditure of capital on gas-works undertakings differed from that on electric light undertakings in this way: The money which the Electric Light Committee recently asked for it was intended to spend at once. But the gas undertaking required a lump sum upon which they could draw from time to time, and from which they could lay out money on new mains, additions to plant, meters, and so forth. They could not apply for borrowing powers every time the Council sanctioned the putting up of a dozen lamps in the new streets; and, in consequence, they had to get borrowing powers for a certain sum, and draw upon it. A well-known illustration of this was that they had lately spent £9000 on water-gas plant; but the sanction to raise the capital was obtained fourteen years ago, and it had not been utilized till now.

Alderman MARRIOTT seconded the motion. With regard to the provision that the surplus revenue might be applied in extending or improving the works, he said he did not want to raise this particular point then, but it struck him that if the Corporation carried on a large undertaking of this kind the city ought to reap some benefit by it; but if surplus revenue was to be applied, or might be applied, in extending the works, it was a bad principle. Such expenditure ought to come out of capital.

The TOWN CLERK (Mr. L. Beard) said that, under the powers proposed, the Council might do what they pleased. The Bill did not bind them to spend anything on extending the works; it only conferred powers.

The report was then adopted.

Alderman ANDREWS next moved a formal resolution sanctioning the promotion of the Bill; and it was carried unanimously.

A meeting of ratepayers was held last Wednesday to consider the expediency of promoting the Bill above referred to. Alderman Andrews explained its provisions, and, in answer to questions, stated that the new site selected would be large enough to provide works in case it should be thought desirable to remove the present works from the city altogether. There was, however, no project on foot for this measure being taken. He reminded the meeting that the Council purchased the gas undertaking fourteen years ago. It had since then paid its way, the wages of the workmen had been increased, and the price of gas reduced from 3s. to 2s. 4d. per 1000 cubic feet. Taken in quantities, it was sold as low as 2s. 2d. The consumption had increased so enormously that the present works could not be enlarged except for producing water gas. Since the Corporation had owned the works, they had made a clear profit of £50,000. The policy of the Gas Committee had been to charge consumers outside the municipal boundary an extra 6d. per 1000 cubic feet. He could not give any pledge that the price would be reduced at Foleshill, though he quite sympathized with the views expressed in this direction. Foleshill had its gas as cheap as consumers in London—viz., 2s. 10d.; while at Bedworth the price was 4s. 6d. The question of the total removal of the gas-works from the city, was one for consideration next. It would involve the city in a cost of between £100,000 and £150,000. The resolution giving formal consent to the Bill was unanimously carried.

The Foleshill Parish Council were lately discussing the above-named project of the Coventry Corporation to erect gas-works in their district; and it does not meet with their approbation. They regard the action of the Corporation as one which will have the effect of planting a "nuisance" in their midst. But it seems that they will be prepared to tolerate it if the inhabitants have their gas at the same price as is charged in the city. A resolution has been passed to oppose the Bill which the Corporation have promoted to sanction the scheme.

ROCHDALE CORPORATION GAS AND WATER WORKS.

The Past Year's Business.

In its review of the local events of the past year, the "Rochdale Observer," as usual, makes reference to the work of the Gas and Water Departments. It appears therefrom that the state of trade in the town has not been conducive to any material expansion in the demand for gas; and the increase which has taken place is entirely for purposes other than lighting—viz., for motive power, cooking, heating, &c. Up to Dec. 16, the quantity of gas produced was 275 million cubic feet—an increase of 2 millions only on the nine months of the financial year which have now elapsed. The year, however, commenced on April 1 instead of March 26 as hitherto; and this makes a difference of nearly 6 millions, which would, under ordinary circumstances, have appeared as so much increase this year. There has been a steady advance in the consumption of gas during the past two or three weeks—the average weekly output amounting to 15½ millions. But the earlier autumn months being fine and bright, the demand was then somewhat less than usual. Indeed, November itself brought very little fog; and there has consequently been no exceptional occasion on which the consumption has made a fresh record—2¼ millions being the highest figure reached in 24 hours. The demand for prepayment meters still continues; and there are now 400 in use. The number of cooking-stoves on hire also steadily increases; and so do gas-engines—there being about 120 of these now in daily use. No extensions of plant have been made during the year; but a commencement has been made in the erection of new stables, as the site of the old ones is required for the extension of the plant for the distillation of tar and the treatment of the resulting products. An experimental application of the Welsbach incandescent mantles to some of the public lamps in the principal thoroughfares has recently been made, with satisfactory results so far as the increase in light is concerned; but what the financial result may be, it is (says the writer) perhaps too early to say. In alluding to the work of the Water Department, the position of the Todmorden Water-Works purchase question is explained, after which the improved financial condition of the undertaking is summed up in these words: "The year ended in March last was one of the best the Department had had for a long time; and the annual deficiency was reduced from £5855 in the previous year to £3862—the diminution being nearly the equivalent to a 2d. rate. We are glad to be able to say that the expansion in the revenue has been fully maintained since, and that there is every reason to anticipate a further reduction in the deficit at the end of the present financial year."

EXPLOSION AT THE ROCHDALE ROAD GAS-WORKS, MANCHESTER.

Early on the morning of Friday, the 24th ult., an explosion of gas took place in a purifying-house at the Rochdale Road Gas-Works of the Manchester Corporation. The ignited gas burned under the purifiers, set fire to the platform on the staging and to the wooden casing of one of the elevators, and subsequently reached the roof. The Fire Brigade were quickly on the spot, and soon extinguished the flames. The gas having been promptly shut off, an investigation was made which disclosed the fact that one of the discharging mouthpieces fixed under the bottom of the purifiers had fallen off; leaving an opening 24 inches in diameter, out of which the gas had escaped. Some of the bolts, ⅞ inch in diameter, securing the mouthpiece were broken off just below the nuts, and others had the threads stripped; but all were much corroded at the screwed end. No one was in or near the house when the explosion occurred; and it is not known how the gas became ignited, as all the lights in the house were placed in specially constructed safety lanterns, having no communication with the interior of the building. The bottom and side plates of two purifiers were cracked, and some of the 24-inch connections broken. The damaged purifiers are a set of four, 50 feet by 30 feet, erected in 1894 in an old house situated behind the office buildings, and closed in on all sides. There was consequently little chance for escaping gas to get safely away. Accidents of this kind are always regrettable; but it is perhaps fortunate that the gas became ignited so soon after the escape commenced; for if the space below the purifiers, forming the revivifying-floor, had become filled with an explosive mixture, the offices, as well as the purifiers, must have been completely wrecked.

FATALITIES FROM GAS POISONING.

A shocking occurrence, involving the deaths of two men, occurred at Coventry on Christmas Day. It appears that two workmen named Milam and Rose, were sent by the Dowson Economic Gas Power Company, Limited, to stop a leak in a gasholder at the Coventry Cross Cycle Company's works. The factory was closed on the day in question; and consequently the men had practically the place to themselves. They were spoken to during the day by an employee of the firm, who afterwards left. At nine o'clock on the following night, a workman going into the factory found the men lying senseless in the holder. A doctor was called in, and he certified that they had been dead for some time. An inquiry into the matter took place last Wednesday, when the evidence adduced went to show that an installation for the manufacture of producer gas was erected on the Company's premises some six months ago by the Dowson Company. Recently it had been noticed that the gasholder needed "staying" on the outside. The Company undertook to carry out the work during the Christmas holidays; and sent the deceased men to do it. They were thoroughly capable, and were acquainted with the nature of producer gas. Mr. Alfred Dowson said he had no doubt there must have been some gas at the bottom of the tank. He did not think the manhole cover could have been left off a sufficient time to enable the residue of gas to escape. Had the cover been removed the day before, and the water extracted, it would have been perfectly safe for the men to descend into the holder. It was necessary for them to enter the tank in order to screw bolts on the standards. The Jury returned a verdict of "Death from gas poisoning," and exonerated the firm from all blame in the matter.

Last Wednesday, an inquiry was held at Mortlake concerning the death of Sarah Dodson, aged 74, a widow, who was found dead in a bedroom at The Terrace, Barnes, on Christmas Day. Margaret Edmunds, a servant at the house, said the deceased was in good spirits when she arrived at eleven o'clock on the evening of the 24th ult., and an hour later witness accompanied her to her bedroom, which was on the top floor. She had a candle with her, though there was a gas-burner in the room. The gas was not lighted. Witness heard nothing unusual during the night, nor did she detect a smell of gas. On Christmas Day, witness went to the room, and found the door locked on the inside. She became alarmed, and informed the deceased's friends, who sent for the police. On the door being forced open, the gas was found fully turned on, and the room

filled. Deceased was lying on her face. Dr. Adams deposed that death was due to coal gas poisoning, producing syncope. There was no sign of suffocation. The Coroner remarked that the probability was that the deceased was going to light the jet, but was unable to find the matches. The Jury agreed with this theory, and returned a verdict of "Death by misadventure."

A case of suicide by coal gas was reported last Tuesday. A man named William Wait, aged 52, a clerk, residing at 37, Gunter Grove, S.W., had been greatly troubled about money matters; and on the 23rd ult. he remained in his room, complaining of feeling unwell. The next day, his door being found locked, and no answer being returned to repeated knocks, the police were called in, and Wait was found lifeless in bed. There was a strong smell of gas in the room; three jets were turned on fully, and the lead pipe had been cut through. The chimney was blocked up with newspapers, the bottom of the door was covered up with towels, and the windows, which deceased invariably had open, were closed and fastened. A blunt-edged razor was found, with which Wait had evidently cut the pipe. Medical evidence showed that death was due to coal gas poisoning; and no doubt it was a case of suicide. A verdict of "Suicide while temporarily insane" was returned.

Last Friday, an inquiry was held at Preston relative to the death of John Battersby, 53, a tinplate worker and gasfitter, who was found dead in his bed on Wednesday. Deceased was much addicted to drink, and had many times threatened to commit suicide. On the night of the 28th ult. he was very violent, and was consequently left alone in his house. The following day his son went to the place, and found the front door barricaded and the back door locked. On entering by the window, he detected a strong odour of gas, with which the house seemed to be filled. On the bed in a room upstairs his father was lying dead. The gas-fitting had been removed, and the gas was escaping. The face of deceased was much discoloured; and the body presented the appearance of death by suffocation. The medical evidence went to show that this had occurred; and the Jury returned a verdict accordingly.

THE GENERAL GAS LIGHTING AND HEATING COMPANY OF BRUSSELS.

The report of the Directors of this Company for the year to Aug. 31 last was presented to the shareholders at the annual general meeting on the 16th ult. We learn therefrom that the profits realized in the twelve months ending at the above date amounted to 2,595,837 frs. Deducting from this sum the addition made to the sinking fund and other charges, there was a balance of 1,304,021 frs. available for distribution. After paying the statutory dividend of 25 frs. per share, amounting to 583,875 frs., and making the usual allowances to the Directors and chief officials, a final dividend of 22 frs. 50 c. per share was declared; being 47 frs. 50 c. on each share, or at the rate of 9½ per cent. per annum, as compared with 9 per cent. for the previous year. This left a balance of 10,421 frs, against 18,175 frs. before. In the year covered by the report, the Company obtained a new concession for a period of 29 years for the town of Petite-Synthe, near Dunkirk. In Prague, they have secured the concession for Wysocan for 25 years, and an extension for 10 years in the case of that for Lieben. The Company have now a total length of 840,910 metres, or in round numbers 925,000 yards, of mains laid; and from them are supplied 21,327 consumers (using 262,242 lights), 14,695 public lamps, 15,502 gas-stoves, and gas-engines furnishing 1928-horse power. The quantity of gas sold in the past financial year was 27,080,251 cubic metres, or about 956 million cubic feet, as compared with 26,047,042 cubic metres (919½ million cubic feet) in 1895-6. In addition to the undertakings owned by themselves, the Company are shareholders in those supplying Carcassonne and Lisbon. The results obtained at the former place last year were better than in the preceding twelve months; but this was not the case at Lisbon (where the Company supply both gas and electricity), in consequence of strikes and a high rate of exchange.

THE TRANSFER OF THE PHILADELPHIA GAS-WORKS TO THE UNITED GAS IMPROVEMENT COMPANY.

Reference has already been made to the above subject in the "JOURNAL." It appears that the transfer was not effected without resort to legal proceedings, for an attempt was made to prevent the carrying out of the Philadelphia Municipality's engagement. An injunction was applied for; but this was effectually disposed of by Judge Arnold, in the Court of Common Pleas. The United Gas Improvement Company are now in control; and the general impression is that the law is all on the side of the Company. The main points in Judge Arnold's decision, as summed up in the Philadelphia "Ledger," are: "The statutes of the Commonwealth of Pennsylvania only confer the power to run the gas-works and light the streets of Philadelphia, and do not impose a duty such as the city is forbidden to delegate to other parties. The decision of the city to make a lease to a corporation, and discard the propositions of other bidders, was but an exercise of a discretionary power vested in the Municipality, with which the Courts cannot interfere. The Philadelphia Gas-Works are not a department of the City Government, but is a private enterprise of the Municipality; and the lease, therefore, does not delegate such a governmental function to another as is forbidden by law. The lease will not invalidate or impair the contracts for a loan created to procure money for improving the city gas-works, because the provisions in that loan for the reservation of certain receipts of the gas-works to pay interest and create a sinking fund only amounted to promises by the city, and did not create a legal contract. The Court refused to pass an opinion upon the question as to whether or not City Councils had a power to enact ordinances which would tend to interfere with or impair the legislative functions of future Councils, contending that such a question was premature." Referring to this matter, the "American Gaslight Journal" says: "The complete history of this affair all goes to show that the third city in the United States, after an experience of well over fifty years in the management of its gas-works, has decided that such control is neither profitable to the taxpayers nor serviceable to its citizens as a whole; which determination, as a practical example, should and will have more effect in puncturing the wind-filled arguments of the advocates of paternalistic government than anything else that may be advanced by those who believe that the underlying and only motive for governments is regulation of the policy of a people rather than their commercial direction." "Progressive Age," commenting upon the transfer, says: "The people of Philadelphia are already beginning to recognize the contrast between the new departure and the old *régime*—the difference between a corporation which does business on well-defined lines, which contemplates, through close attention to affairs, to earn a return on capital invested, and the slipshod happy-go-lucky methods of political jobbery. We venture now the prediction that the Philadelphia Gas-Works will never again come under the domination of the Municipality. When the thirty years' lease expires, the public will find the lessees ready to render an account of their stewardship; and it will show that the continuance of the present or some modified form of lease will be imperative."

AMALGAMATED WATER-GAS COMPANIES, LIMITED.

Statement by Mr. Samson Fox—Proposal to Liquidate.

The Annual General Meeting of the shareholders in the above-named undertaking was held in Leeds last Friday—Mr. SAMSON FOX, the Chairman, presiding.

The Directors presented a report on the working of the undertaking during the year ending the 30th of September last. They commenced by stating that in the report issued prior to the 1896 meeting, the Board expressed the opinion that it was desirable to postpone the extraordinary meeting to deal with the question of providing further capital for the purposes of the Company's business, until after the hearing of the libel action brought by Mr. Fox against the Editor and Publisher of "To-Day." It was decided to call the meeting as soon as the trial was over. For various reasons, which it was stated Mr. Samson Fox would explain to the shareholders, this had been postponed. Under the circumstances, it had necessarily been impracticable to do any profitable business; but much work had to be done in connection with the liquidation of the vendor Companies. The accounts accompanying the report showed a loss of £591 on the trading account. This the Directors attributed in a great measure to the writing down of stock, and also to the expenses in connection with the plant erected at Messrs. Spencer's. Among the liabilities shown in the balance-sheet, the sum of £528 11s. 2d., due to the Executors of the late Mr. J. R. Stewart, was in regard to the Uddingston property, as to which the Company were liable to the extent of £15,000. The Trustees of Mr. Stewart's estate released the Company from all liability in respect thereof, except as to the balance of unpaid interest. The sum of £1530 12s. was shown on the credit side of the balance-sheet as profit arising from this transaction. There was a sum of £4838 9s. 3d. for sundry creditors. This included the reduced claim for fees of the Directors of the North British Syndicate, as to which both Mr. Fox and the Trustees of the late Mr. Stewart have waived their claim. Hope was expressed that the remaining three Directors would adopt the same course; thus reducing the liabilities by a sum of £2500. The loss on the profit and loss account was £1679. The sales amounted to £353; and the royalties to £137. The Company's patents stood in the balance-sheet for £187,568.

Mr. Fox had issued a circular to the shareholders setting forth the result of the proceedings in the libel action brought by him against Mr. Jerome, and expressing his intention of resigning his position as a Director of the Company—at the same time promising to explain matters more fully at the meeting.

The proceedings having been opened,

The CHAIRMAN read the following statement: You have before you the report of the Directors; you have also read a short circular issued by myself, with which I propose to deal later on. I wish first to direct your attention to the report of the Directors, and the balance-sheet of the Company for the year 1897. It is not to be disguised for one moment—and I should be the last person to attempt such a thing—that the affairs of the Company are not in a satisfactory condition. As a concern, the Company has certainly turned out a commercial failure. None of you can conceive the regret and the pain with which I am forced to make such a confession. When the British Water-Gas Syndicate came into existence, I felt confident, beyond the shadow of a doubt, that it was going to have a continuous life of uninterrupted prosperity. From one cause and another, every one of my hopes as to this coming about has been shattered. Finally, as you all remember, it was considered advisable by a vast majority of shareholders to amalgamate the three Water-Gas Companies; and still I thought, when that was brought about, that we were going to have a career, if not of great, certainly of substantial, prosperity, in that we should be able to pay dividends at last. However, owing to the delays of liquidation necessitated by the non-payment of calls in arrear, owing to the lack of working capital which consequently ensued, and also owing to the persistent litigation with which the paths of myself and my co-Directors and the Liquidators have been beset since the date of the amalgamation, the Amalgamated Water-Gas Companies have been unable to do any profitable business; and so we come to the present position. We have been able to relieve the Company of its greatest debt—viz., that to the Executors of the late Mr. James Reid Stewart. They have taken back the works at Uddingston, and relieved us from paying the purchase price of £15,000. There is another sum, too, to which your attention should be directed. It is not as formidable as it appears on the balance-sheet—viz., the sum of £4838 9s. 3d.; due to sundry creditors. A large part of this includes the Directors' claim for fees of the North British Directors. The Trustees of the late Mr. Stewart and I myself waive our claims; and I have no doubt, from my own personal knowledge of the three remaining Directors, that they will also do the same. In that event, there will only be really due to creditors a sum of some £2300, and a substantial part of this will be due to the liquidation of the three original Companies. As, moreover, there is a very substantial sum in arrear on calls in the three Companies, I hope and believe that this indebtedness will be well provided for. The other two substantial claims are those of Mr. Reid Stewart's Executors for interest, which has now for some time been overdue, on the purchase price of

the Uddingston works, and the overdraft made by our bankers on the security of unpaid-up calls. The Liquidators will have the first claim on these unpaid-up calls, and then the bankers will come in; and I am in hopes that the Liquidators and the bankers will be provided for. The only other comment I have to make upon the balance-sheet is to direct your attention, frankly and candidly, to the loss that has been made on the trading account, which, together with the other expenses attaching to the carrying on of the Company, have resulted in a net loss of £1679 0s. 8d. for the year ending Sept. 30, 1897. The Company having practically done no business this year, this loss could not very well have been averted. During the earlier part of the year, I myself was engaged in very heavy litigation, connected with the affairs of the Company; and during the summer and autumn of this year, my health has been somewhat impaired, and I have not been able to devote to it the time, attention, and energy which I used to do in former years. I shall refer to this later on in my speech. Owing to the fact that the Company has not a staff, or the means of securing business on a profitable scale, it is inevitable, if it were to do business profitably, that the position should be seriously considered, and that the whole capitalization should be considerably modified, if not altered. Last year I intended to put before you a proposal which would have offered a solution (as I think a satisfactory solution) for these different matters; but, owing to the advice of certain friends of mine, I thought it better to defer making this proposal until after the action which was then nearing trial—myself against Mr. Jerome—had been determined. Conscious that I had done no wrong, I had every hope and confidence that this action would result favourably to myself; and had the result been other than it was, I should certainly have come before you, and offered to do all that I could, and to make any sacrifice to set the Company on its legs again, and once more to place it in a satisfactory position. I had a scheme, by which I would have put down a substantial sum of money to provide working capital; and, more to ask your confidence than to finance the concern, I would have asked all the shareholders to contribute a like amount of money. I would then have devoted my energies to securing a competent staff, and to procuring orders for plant. I should not have rested until I had demonstrated at the works of Messrs. John Spencer and Sons, Limited, that water gas could be, and would be, an undoubted success for steel smelting, and that its advantages in large furnaces over every other form of gaseous fuel now known—advantages which would make it worth while to adopt it at numerous other works—were real and substantial. Though I had this scheme fully set forth and considered, as I have already told you, on the advice of my friends, who I now think acted rightly in the matter, I did not put it before you. We determined to wait until the case of myself against Mr. Jerome had been decided. The case did not come on as rapidly as we originally thought; but on the last day of March it did begin, and continued till the middle of May; being adjourned over the Easter Vacation. The Judge told us that it was the longest libel case that he had known of in his experience. Mr. Jerome had made serious charges against myself in connection with, among other matters, the British Water-Gas Syndicate, Limited. I put before the Court every single transaction that I had had in connection with water gas. Neither Mr. Jerome nor his Counsel could suggest that for a moment the slightest thing was kept back. The Judge and jury, and the whole world, are now aware of everything I did in connection with water gas. The severest investigation that the late Sir F. Lockwood ever made into any matter was made in this case. I subjected myself to a very long and wearying cross-examination; and there was not a single question that I did not answer, and Sir F. Lockwood was unable to complain that I had given either incorrect or prevaricating answers. Conscious that I had done everything in good faith and honestly, and with the desire not only to benefit myself but others, I made everything as clear as possible about my connection with water gas from the moment when I first knew of it in 1882 down to the date of the trial; and all of you, who care to know about the history of water gas can read it quite clearly in the transcript of the proceedings of *Fox v. Jerome*. At the end of this long and anxious trial, the jury retired to consider their verdict, and were absent for over an hour. They found a verdict for me; but they only gave me one farthing damages. I must confess that I was certainly disappointed at this result. What I wanted and expected was a substantial sum—not a great sum, but a substantial sum—to mark their sense of the wrong which Mr. Jerome had done me. It is quite true that, in arriving at their verdict, they knew that Mr. Jerome, who is, I believe, not a very rich man, would have to pay his own costs, which, I understand, amounted to several thousand pounds; and doubtless they considered that this was a very serious and substantial amount to pay for having libelled me. Moreover, Sir F. Lockwood told the jury again and again that, as I had got, according to his version of the story, so great a sum of money out of the public, I ought not to receive any more at their hands. I believe that I am not doing him a wrong, or Mr. Jerome, in saying that at least it was one of the views of the case which he put to the jury. I quite admit that he coupled this with many other caustic remarks; but there is no doubt that this view of the case made a great impression on the jury, as it also undoubtedly did on the Judge. I have Sir E. Clarke's authority for saying that he is convinced it was this view which made the greatest impression on the jury, and which led them to give a verdict of only nominal damages to myself. They knew that I was well enough off to bear the burden of the day, whatever happened; and that even a substantial sum of money would not make much difference in any event to the costs which I had to incur in the action, apart from the time and anxiety which I devoted to it. I have Sir E. Clarke's authority also to say that every single one of the charges which was brought against me by Mr. Jerome was disproved, not only by myself, but by direct and absolute evidence, which is now on record. You cannot name a single charge which Mr. Jerome brought against me, but that I can refer to the transcript of the evidence, and show you by whom and in what way it was refuted. Sir E. Clarke is not a counsel who, if he disbelieved such a matter, would give me authority for repeating it. I say, and I ask you to confirm it by referring it to the evidence, that all my dealings in water-gas shares, with all my statements in the water-gas prospectus, and also my connection with the Company, were honest and *bonâ fide*, and were conceived with the object of doing the best possible for all the shareholders of the British Water-Gas Syndicate. I have made mistakes, I admitted that in the witness-box. I plainly stated that, if I had to do it all over again, I would not do it. I now know that, working man as I was, and a man who was constituted by nature for engineering pursuits, I should not have mixed myself up with company matters. I looked at everything in 1888 and 1889 through too rosy spectacles. It was a period when there was great financial prosperity in England, and everything seemed to be going right. So when water gas turned out such an unqualified success at the Leeds Forge, I certainly thought that we were going to see an industrial revolution such as often happened in my experience; and that in securing the water-gas patents—which I then believed to be not only the best on the market, but to give a practical monopoly—the shares of the British Water-Gas Syndicate were going to be worth £30, and perhaps £50 apiece. Well, it is a long story, and I do not propose to go over the ground again; but I do say this, that I was very disappointed the jury should only have given me nominal damages. I did not care about getting costs out of Mr. Jerome. Had I been given them, I probably should not have asked him to pay them; but I should have liked to have got—however small might have been the amount—a sum of money which would have marked the jury's appreciation in a more definite form that I had really won the case. Whatever their views might have been, however, they did not do more for me than give me the verdict; and I have, perforce, to recognize the opinions and views of that wide public which does not closely follow the evidence of a case, but which forms its views and opinions by the result. I feel—and no one feels it more acutely than myself—that when a man gets only a farthing damages in a Law Court, the public views the verdict as unfavourable to himself. I have looked at this matter from every point of view; and, arriving at as impartial a conclusion as I can personally form, I say now with regret, but without hesitation, that the verdict in the case of *Fox v. Jerome* must necessarily alter my relations and my connection with the Amalgamated Water-Gas Companies. The jury before whom I was fighting was not only the jury of the Law Courts, or the jury of my fellow-shareholders—it was the jury of public opinion; and no vote of my fellow-shareholders would affect the general impression created with regard to the evidence in the case of *Fox v. Jerome*. I believe that those who followed the evidence closely, amongst the public, could have come to no other conclusion than that I had acted honestly and *bonâ fide* in all my transactions; and, hoping and believing that, I am content to rely upon such opinion of myself. Well, the verdict was given in May. For some time previous, I had been constituting a change in my household; and I was busily engaged in moving to another residence. What with this change, and the anxiety and excitement of this great case, I was advised to take no part in business transactions, and spent the summer resting and recuperating. That was my reason for not calling you together immediately after the case of *Fox v. Jerome*, as I had originally contemplated last year. Then came the question for me to decide, whether I should call you together and put before you the proposition I meant to have done last year, or whether I should call you together and put before you the proposition which I am now doing. Some of my friends thought that I ought to do the one, and some thought I ought to do the other; and for some time I was unable to make up my mind which was the right and proper thing to do. However, I have now made it up; and I think that it is right and proper that I should not offer myself for re-election as Chairman or Director of the Company. I still remain a large shareholder; and I shall devote my shareholding to any purpose which my fellow-shareholders think to be right, and shall abide by their decision in the matter. There is one other matter connected with the alternative proposition—namely, that of continuing the existence of the Company—with which I ought to deal. That is the subject of acetylene. Happening to be in the United States in the autumn of 1894, my attention was directed to acetylene gas, and without going into the matter in detail, I saw that it had large possibilities; and I thought it might be desirable to acquire the calcium carbide patents, which deal with this matter as far as this country is concerned, for the Amalgamated Water-Gas Companies. I therefore paid a substantial sum of money, and entered into a contract to form a Syndicate, which should acquire the same on certain terms, and then began to look into the matter more closely. I at once saw that the acetylene question was not so ripe and mature as I originally thought, and that a number of costly and lengthy experiments would have to be made. I could not call upon the Amalgamated Water-Gas Companies—I did not for a moment think of doing so—to bear any portion of this expense. The result was that the longer these experiments went on, and the more money that was sunk into the venture, the more I realized the difficulty of devising some plan by which the Amalgamated Water-Gas Companies could participate beneficially in this matter. The result is that my interest in the acetylene business is comparatively small to what it was, as there are several parties now interested. I have endeavoured to make you as well acquainted as possible with my position, and with the various facts and circumstances which have finally induced me to reconsider my relations and connection with your Company. It is a hard thing for me to come and meet you and make such an explanation as this; but I have felt that it is the manliest course. I have felt, I say, that this was the right and proper thing to do; and after carefully conferring with friends and other persons well qualified to judge, they have also come to the same conclusion. Whatever course I should take now would be criticized. The question is: What course I can take with the greatest propriety; and I think that the verdict in the case of myself against Mr. Jerome leaves no question but that I should not offer myself for re-election, and that I should cease to be a Director of your Company—that is the conclusion I have come to. I have only a few more words to add on the subject. My co-Directors have stood loyally by me; relying upon my promises in time past that I would do all that I could to enable the Company to continue its existence. Those promises, as I have said, were given with a view to other eventualities, and have now had to be reconsidered. At the same time, I must commend to you the attitude taken up both by Mr. Procter and by Mr. Worth; they have been loyal to the Company, and they have been loyal to me. I have only to say this—that, having now done all they could in your interests, they have considered that, as I am about to retire from the Company, it is also time for them to do so. Mr. Procter, you will remember, lost a very large sum of money; and it was in consequence of his large stake in the Company that he was invited to join the Board in 1889. His first introduction to us was on his appointment

as a Committee of Investigation. But he satisfied himself that everything that I had done in connection with the Company, and that the others had done, was done honestly and *bonâ fide;* and he also satisfied himself that there was at that date a future for the Company. These views he has entertained from that day down to now. The point then occurs to me whether we have not reached the stage when we might consider the subject of its liquidation. The Water Gas Company has largely been bound up with me, and when I cease to be actively connected with it I cannot help reflecting that most people will regard it as defunct. The Company, too, seems to have come to the natural end of its existence. While, as far as I understand its financial affairs, it is not exactly insolvent, still its floating assets can only just meet its liabilities. Its most substantial asset—the water-gas patents—depended upon the business done by the Company; and the Company, lamentably and to my regret, failed to do business during the best part of the term of those patents. Therefore, with reluctance, I come to the conclusion that, now that the patents are about to expire one after another, it would not be in reliance upon them that the Company could do business in the future. It would want cash working capital; and if I were now to come to you and ask you to subscribe more money together with myself, and if the concern were again to prove unremunerative, I should merit even more criticism than I already have incurred. That being so, I put it to you—I do not suggest it, I do not advise it, but I simply put it to you—to consider whether the time has not arrived when you think that the Company ought to pass into liquidation. It has been suggested by Mr. Jerome and others that I personally have reasons to fear the Company going into liquidation. That statement is absolutely untrue. I have never had such fears in mind when desiring that the Company should not cease to exist. When I proposed that it should continue to exist, I had the greatest confidence that the Company would yet turn out a prosperous concern. To-day I believe in water gas as much as ever I did. To-day water gas is everywhere a decided success. You can hardly point to a large town which has not adopted it; and you can hardly ask any one to whom is that introduction due, but that you will receive the reply that it was I who introduced it to the attention of the gas manufacturers and the gas users of this country. But I am sorry to say that, going too fast to work, and surrounded by unpropitious circumstances, we failed to obtain the business ourselves, and that competitors sprang up on all sides who were able to secure the trade which we should have got. Therefore, if we go into the field again, it is true that we go protected by certain patents; but I must recognize that we shall compete with great disadvantages. Undoubtedly, your Company's reputation has suffered; and we should have to get over other disadvantages. Moreover, I myself am not equal to the strain of what really amounts to building up a new business right from the start, organizing a staff, securing works, and getting orders; and that being so, I think that only someone who is devoted to the water-gas industry, and who is as great a believer in it as I myself, could accomplish such a task with success. Looking at all these things, I imagine that, as my co-Directors and myself are resigning from the Board, there will not be any others who are desirous of taking our place, and continuing the business of the Company; and in that event, it remains for the shareholders to do what they think fit. It occurs to me that the best course to adopt will be to wind up the Company's affairs. It has been so often stated that I am afraid of liquidation, that I almost court the Company going into liquidation, and having a most searching investigation of all that has happened. The affairs of the Water-Gas Companies have been in several Courts of Justice, and several Judges have been able to put their fingers upon nearly every transaction in the whole history of the existence of the British Water-Gas Syndicate and of the other Companies; and not one has been able to say that what I and my co-Directors may have done in relation to these Companies has not been done honestly and with the best intentions. Painful as it would be to me to go through such another investigation as has been made, it is not on account of fear as to its results, or anxiety as to any reflections which might be made upon my character, that I will suggest to you that no liquidator will think such a course advisable or desirable. However, there it is, and I would say to you: Place the Company in the hands of some competent and independent auditors. Select one of the great firms of London—Messrs. Deloitte, Dever, Griffiths, and Co., Turquand, Youngs, Bishop, and Clarke, or Messrs. Cooper Bros.—and I will gladly lay before them all my papers, and help them in every possible way in liquidating the Company's affairs. If, on the other hand, you want to do something besides voluntarily liquidating the Company, it is open to you to direct the liquidators to wind up under supervision of the Court; and there is yet a third course open to you—and that is to place the affairs of the Company in the hands of the Official Receiver, and go through the process of compulsory liquidation. However, before coming to any decision on these matters, as I wish to leave it absolutely to yourselves to decide, it has occurred to me that you might like to appoint among yourselves a Committee of Inspection. You can do this either before resolving that the Company goes into liquidation, or you can do it at the same time as you appoint your voluntary liquidator; and you can direct the attention of your Committee of Inspection more particularly, if you so desire, to the possibilities of the Company, so that they can estimate the value of the patents and the chances of doing profitable work. In this event those of you who still believe in water gas might like to subscribe among yourselves a small sum of money and continue the work of the Company—of course, having a preferential interest in it both as to dividends and capital. Your Committee of Inspection might also advise you as to which is the most proper course to pursue, and which the best form of liquidation. I only throw these things out for your consideration. Acting after due reflection, and after the advice of my friends, I think that it is better, both in your interests and in my own, that my active connection with the Company should now cease. In conclusion, I have only to repeat what I have so often said—that nothing has grieved me more in life than that so many of you, relying upon my engineering successes, and believing in me, have invested large sums of money in the Company, and that these investments have turned out so unremunerative. I have done my best to avert so disastrous a conclusion. Many people think that I have made a large sum of money out of water gas. That is absolutely not so. It is quite true that your Company paid me a very large sum in cash. Part of it was to replace what I was paying the original vendors in Germany; another part of it went to pay the promoters; £48,000 I used to purchase shares; and more money I used in acquiring shares by direct allotment. A large sum of money I advanced to certain gentlemen in order that they should acquire shares, which they did, and which money will never be repaid to me. Finally, the balance of the money has been swept up in the constant litigation that I have had since water gas was introduced to the public. The result is that I leave the Company poorer than when I entered it. I only wish to say this in order to reassure those of my friends who may think that my position is somewhat different to theirs. I am most sorry that they have lost their money, and I should have been a proud man if the result in Mr. Jerome's case had been somewhat different, and if I had been able to come forward and justify all that I had done, and been able to start the Company on a new career—a career of success and prosperity. However, this was not to be; and I only say that I trust and hope and believe nobody else has suffered so severely and so acutely by his connection with water gas as I have.

Some questions having been put by shareholders, the report and accounts were passed. It was subsequently resolved that the meeting should be adjourned till the 31st inst.; that immediately following that meeting there should be an extraordinary general meeting at which a resolution should be proposed for winding up the affairs of the Company; and that the name of Mr. John Gordon, jun., should then be suggested as liquidator.

ELECTRIC LIGHTING NOTES.

The Norden District Council have adopted the electric light for illuminating a portion of their district. The current is generated by means of a two brake horse power engine driven by gas drawn from the mains of the Rochdale Corporation.

The Electricity Committee of the Glasgow Corporation have recommended the selection of Mr. W. A. Chamen (Outdoor Manager to Messrs. Crompton and Co.) for the position of Chief Engineer of their electric supply undertaking, *vice* Mr. W. Arnot resigned.

At the Sheffield General Post Office on Christmas morning, the (at such times) arduous labour of sorting both parcels and letters was delayed for fully an hour and a half owing to the vagaries of the electric light, which simply refused to beam. Wax candles were requisitioned; but their faint glimmer did not suffice to carry on the work. The Post Office does not supply its own electric current.

It is reported that the Local Government Board have again refused to sanction a loan to the Peterborough Town Council for electric lighting, on the ground that the borrowing margin of the borough is insufficient. This is said to have caused some surprise among the electrical enthusiasts in the Council, who are of opinion that the Board are labouring under a misapprehension as to the financial position of the borough.

Though they have decided to apply for an Electric Lighting Order, the Ilfracombe District Council seem to have very hazy ideas of what they are going to do with it. At the meeting which was held to confirm the resolution to apply for the Order, two or three members expressed the hope that when it was granted the Council would proceed forthwith to carry it out themselves. On the other hand there were members who declined to vote for the resolution unless it was made clear that they had power to sell or lease their rights to a private company. They did not like the idea of the Council taking the responsibility; and one gentleman confessed that he thought it would be a waste of money. Mr. Braund, the mover of the resolution, expressed the opinion that, if the electric light were established by the Council, the lighting of the town would cost only £600 as against £800 now paid to the Gas Company. Mr. Palmer challenged this statement, and said he would like to know of an electric light company who made public lighting pay. However, the Council are to proceed with their application; and presumably they will then decide whether it shall be carried out, and how.

Colonel J. T. Marsh, of the Local Government Board, has held an inquiry at Portsmouth relative to an application by the Corporation for sanction to borrow £21,000 for electric lighting purposes. It was explained by Alderman G. Ellis that the money was required for additional boilers and other plant, mains, meters, &c. Referring to the general position of the concern, he said they started the last financial year with a deficit of £2715, due to the interest which accrued on the sinking fund during the construction of the works; while at the end of the year, after having paid all the expenses of working, maintenance of plant, interest and sinking fund, the deficit was reduced to £391. Since then, loans had been granted for new engines; but unfortunately the engineers' strike had prevented the erection of the engines. Therefore, the revenue would be less than the estimate, although it would be ample to meet all requirements. In addition to the difficulties caused by the strike, they had had to hire machinery in order to get through Christmas work, and had reduced the price of the current to 4½d. per unit. Alderman Ellis added that the profits last year were within a fraction of 8 per cent. on the capital expenditure. Some detailed information was given by the Consulting Engineer (Mr. Manville) as to the work proposed to be carried out.

An inquiry was recently held by Colonel Durnford, representing the Local Government Board, into an application by the Stockport Corporation for permission to borrow £25,000 for electric lighting purposes. Mr. T. Webb, the Chairman of the Gas and Electric Lighting Committee, was present, as well as Mr. J. N. Shoolbred, the Engineer of the scheme. The Inspector was informed that the population of Stockport is now 78,000; its assessable value, £269,439; and its total debt, £504,662. The Town Clerk (Mr. W. Hyde) replying to the Inspector, said the Corporation required as long a period as they possibly could obtain in which to repay the money borrowed. Mr. Shoolbred presented particulars showing that it is intended at first to supply the leading business thoroughfares of the borough with the electric light, which will be at the disposal of private consumers. The buildings at the central station, &c., will cost £3000, which, with £11,200 for generating plant, brings the total cost of the station to £14,200. The estimates for the distributing plant in the town were: Feeding mains for the central station, £3000; distributing cables, £2000; street boxes, crossings, trenchings, &c., £1500; house services, meters, and contingencies, £1500; engineer's and other fees, parliamentary and similar expenses, £2800—total, £25,000. The proposal to adopt the electric light being very popular in the town, there was no opposition.

NOTTINGHAM CORPORATION WATER ACCOUNTS.

The Water Committee of the Nottingham City Council have issued their report and accounts for the year ending March 25 last—the mass of figures revealing that the balance of profit amounts to £4131. From the brief report which prefaces the balance-sheet, it appears that the revenue has increased by £2516, and the expenditure by £262—the latter sum being accounted for by increased rates and taxes, interest on loans, &c. The £4131 which remains after payment of annuities and interest on loans and consolidated stock, and the annual contributions to the renewal fund and the different sinking funds, has been carried forward to the account established last year to provide for the estimated expenses incurred in seeking further supplies of water. An analysis of the profit and loss account shows receipts £71,660, of which £69,160 represents the water-rents for the four quarters (including the amount due at Lady-day and Christmas, 1896), and the arrears from last year (£123). The amount, however, does not contain the quarter's water-rents due at Lady-day last. From the details given in the account, it is gathered that the sum collected in water-rents for the first quarter named was £16,759 (due Lady-day, 1896); for the Midsummer quarter, £17,114; Michaelmas, £17,788; and Christmas, £17,375. On the expenditure side, pumping expenses and repairs amount to £6718; distribution and workshops to £5598, with reservoir expenses £183—making a total of £12,500 for the Engineer's Department. Salaries, incidentals, office expenses, &c., amount to £4515; parochial rates and taxes, to £5593; income-tax, to £1033; and interest on consolidated stock, to £10,403; annual instalments on sinking funds (consolidated stock £2282, annuities £2430, ordinary loans £80), £4793.

MID-SUSSEX WATER-WORKS ARBITRATION.

Westminster Palace Hotel—Monday, Dec. 13, 1897.

(*Before Sir* GEORGE B. BRUCE, *Umpire.*)

The Cuckfield Rural District Council having given notice to the Mid-Sussex Water Company of their intention to purchase their undertaking, an arbitration was commenced to-day for the purpose of ascertaining the sum to be paid.

Mr. R. E. MIDDLETON, M.Inst.C.E., was Arbitrator for the Company; Mr. JAMES MANSERGH, M.Inst.C.E., for the District Council. Mr. CRIPPS, Q.C., M.P., and Mr. SCOTT FOX appeared for the Company; Mr. BALFOUR BROWNE, Q.C., and Mr. BOXALL represented the Council.

Mr. CRIPPS said the Local Authority had given the Water Company notice to purchase under section 91 of the Mid-Sussex Water Act, 1890. Having read the section, the learned Counsel said he was not aware of any water undertaking that had been transferred under exactly similar conditions to that of the Mid-Sussex Company; the special point in the present case being that it was a new concern which was not developed. The Company, which was only started in 1890, had expended their capital, and had not yet reaped the fruits of it. The district comprised Balcombe, Ardingley, Lindfield, Wivelsfield, and Cuckfield.

Mr. BALFOUR BROWNE said he understood that some of the Company's powers had lapsed.

Mr. CRIPPS said their well was in Balcombe, and was capable of supplying 225,000 gallons per day; and at the present time they could pump from it about 180,000 gallons daily. They had not, however, duplicate machinery, which, of course, they ought to have; and the only reason they had not, was because the Local Authority had given notice to purchase. The special feature of the district was undoubtedly the enormous extension which was going on in Hayward's Heath, and the consequent development of the Company's business. The water-rental to Dec. 31, 1891, was only £9 16s. 1d.; but for the half year ending June 30, 1897, it was £749 15s. The question arose as to how they were to value the undertaking. It was obvious that they must look at the prospective advantages. The water-rental for 1897 was estimated, after deducting 1½ per cent. for empty houses, to be £1835. From this gross figure, they considered that 40 per cent. should be deducted for working expenses. These for the first half of 1897 were 44 per cent. of the gross revenue; but as the revenue was increasing, and there were many fixed expenses, it was considered that 40 per cent. could be fairly taken as the normal figure. This gave a net profit to be capitalized of £1101. Capitalizing it at 33⅓ years, gave a total of £36,700. Coming to the second head of their claim, at the present time they were supplying 856 houses, which gave £2·15 per supply. There were 650 houses on the line of the existing main which had not yet taken the Company's water, but 90 per cent. of which might reasonably be expected to do so; and this 90 per cent. would, it was considered, within seven years produce an additional yearly rental of £1236. If this addition were discounted on the 3 per cent. table, it would be equivalent to an immediate gross revenue of £1096. Taking off 40 per cent. for working expenses, and using the same multiplier of 33⅓ years' purchase, it gave £21,933 as the second figure in the claim. The third item of claim was for supplies to houses along the lines of proposed mains. There was a 4-inch main to be laid between Balcombe and Lindfield, a distance of 6½ miles, with a branch to Ardingley 1⅓ miles long, and an extension to Bedaleshill House 1·1 miles long. Multiplying by the £2·15 the supplies which these extensions would add, discounting the amount at 3 per cent., deducting working expenses, and capitalizing as before, gave £8233 for the third head of claim. The fourth and last item was in respect of supplies to new buildings; and this figure, based on an average of the past six years, after deducting the 40 per cent., came to £1008. In order to be on the safe side, his witnesses had reduced this figure to £700, which at 33⅓ years' purchase gave £23,333 as the fourth item in their claim. These four items totalled up to £90,199. A certain deduction had to be made from this sum for the expenses of duplicating the machinery, making additional adits, and laying down the necessary mains. It was estimated that £6600 would be required for this, which, deducted from the £90,199 would leave £83,599. To this there was to be added a small amount of £430 for plumbing profit; making £84,029, which with 10 per cent. for compulsory sale made the total claim £92,432. This amount would give them at the end of twenty years about 6 per cent. on their expenditure, which was not a very extravagant sum to suggest.

Mr. *G. H. Hill*, M.Inst.C.E., in reply to Mr. CRIPPS, said he did not know of any instance where a water company's undertaking had been acquired at such an early stage of its existence; and it was obvious that in such a case it had not yet reaped the fruit of its expenditure. The district in the present case was one where they must either have an authority or a company, apart from local private supplies, because the shallow wells in the locality were very unsatisfactory. Witness then confirmed the figures given by the learned Counsel. With regard to the working expenses, he said that in 1894 they were 100 per cent.; in 1895, 74 per cent.; in 1896, 57 per cent.; and in the first half of 1897, 44 per cent. He had therefore taken 40 per cent. as a fair allowance; and he considered 33⅓ years was a fair purchase price. At present the Company's well yielded 180,000 gallons of water per day; and he thought it could furnish a very much larger quantity than the 223,000 gallons which he estimated would be required daily when the additional supplies came in.

Mr. BALFOUR BROWNE (in cross-examination): Do you think a company that takes its powers with a possibility of being bought out in three months is in as good a position as one that has no such sword hanging over it?

Witness: Of course, it stops all development.

In your valuation you are calculating for an absolute safety of tenure for twenty years. Are you aware that the Company took their power subject to three months' notice?—I did not know that it was a three months' notice.

In reply to further questions, witness said he had never heard of a structural valuation. Supposing the power to purchase subject to three months' notice deprived the Company of all prospective value beyond the three months, every one of the calculations, except the £36,700 under the first head of claim, would be affected. With regard to the working expenses, the figures had been given to him; but the accounts showed that in 1894, with a gross rental of £683, the repairs and maintenance cost £118, and in 1897, when the revenue was more than double, the repairs were only £17 15s. 3d.

The UMPIRE: What has the £17 15s. 3d. to do with it?

Mr. BALFOUR BROWNE said it showed that the repairs in that particular year were scamped, and that if those expenses had been as heavy in 1897 as they were in 1894, the 44 per cent. would have been much higher.

Witness, in further cross-examination, said that, assuming his figures to be right, the capital value of the undertaking on the present revenue was £36,700; but he admitted that everything beyond the first calculation was hypothesis—that was to say, prospective. In order to get the £36,700, which was their present value, there ought to be another engine; and he had allowed for this in the estimate. His figure of £2·15 was on the assumption that an addition would have to be made for the extra charges, such as baths and closets. He did not know that, at the only experiments that were made when the Council were represented, the pump broke down. He had put down £1500 for duplicating the engines, though he was aware that, according to the Company's accounts, larger engines, as an extra in the contract, cost £2450; but he did not know anything about the contract. It was quite possible for the prospective value of the undertaking to be 50 per cent. more than the present value; and it was perfectly fair to add 10 per cent. for the sale—he did not like to say the compulsory sale, but for the transfer of the property.

Mr. BALFOUR BROWNE: Supposing the Company agree to sell, you would not put in anything for compulsion?

Witness: Not for compulsion; but I think you ought to pay for the transfer of this money, and the re-investment expenses, and things of that sort.

Do I understand you to say, if it is compulsion, something should be paid for it?—Certainly.

Did you ever hear of a case where more than 10 per cent. was given?—No; I do not think I did.

Therefore the 10 per cent. which you are giving here includes compulsion?—It includes compulsion. As I say, the words "compulsory sale" are a little objectionable; but I have included 10 per cent.

If there was no compulsion, that should not be included?—No; but there ought to be a sum allowed for re-investment of money, winding up, and things of that sort.

If the Company absolutely go for an Act of Parliament and agree with the Local Authority to sell, you could not call that compulsion?—No. But you are to take over this property at its value when you come for it at three months' notice.

You have put on 10 per cent. to everyone of these hypothetical figures. Have you any precedent for such a thing?—The 10 per cent. is generally taken on the whole sum at the end.

Will you give me a single case where it was ever done?—I cannot bring an instance to mind.

In re-examination by Mr. SCOTT FOX, witness stated that since 1890, 285 houses had been built in the district, all but 12 of which had taken the Company's water; and the rateable value of the houses had run up from £296 in 1890 to £1328 in 1897.

Mr. *Charles Hawksley*, M.Inst.C.E., in reply to Mr. SCOTT FOX, said he regarded Mr. Hill's valuation as a very reasonable one. He thought, however, that in regard to the prospective supplies to new buildings he had taken too low a figure. Mr. Hill had averaged the additional water-rental from this source at £90 per annum; but he (witness) was inclined to put the average at £100. Then, in order to be on the safe side, though Mr. Hill's figure of £90 worked out to a present value of £1008, that gentleman had reduced it to £700 before applying the multiplier of 33⅓ years' purchase. Personally, he (witness) did not think that this was necessary. His valuation, therefore, under this head would show an increase of £10,000; but against that, as he was inclined to take the pipes for the extensions at a somewhat larger diameter than Mr. Hill took them, there would have to be placed additional expenditure of about £5000 on the pipage. Speaking from his experience, and applying the principles which were fair to the taking over of the Company's property, he did not think that £92,000 was at all an exaggerated amount to be paid for the undertaking.

Cross-examined by Mr. BALFOUR BROWNE: The pumps and engines were not sufficient to-day. In order to maintain the supply, there ought to be a duplicate engine and pump. He was not aware that the

present pumps had been tested at half their proper speed, and had broken down twice. As there was no duplicate in case of a breakdown, the Company had been running a risk in using the pumps at the same time for well sinking and supplying. Of course, if there was no revenue, and no possibility of revenue, there must be a structural valuation. He knew that the Company took their power to supply subject to a three months' notice. They might not have assumed this condition willingly; but supposing that they voluntarily assumed it, and that their Bill as introduced into Parliament contained the clause, then he should say that this removed it from the condition of compulsion. In the case of a yearly tenant, he would put him at one year's purchase; and in the case of a freehold, he would put it at 33¼ years' purchase—the 33¼ years in the one instance and the year in the other representing the interest of the person compensated.

Mr. BALFOUR BROWNE: In this case you have multiplied by 33¼, as if it were absolutely freehold, without a notice of three months at all, have you not?

Witness: Yes. I see your argument. I feel sure there is a fallacy in it somewhere; but I cannot put my finger on it at the moment.

Tuesday, Dec. 14.

At the opening of the proceedings to-day,

Mr. CRIPPS suggested that, as regarded the structural conditions, the Umpire and the two Arbitrators should view the works. As to the capacity of the well, it was obvious that this went to the basis of the claim. The Company had given the tests asked for by the Local Authority; but if the Umpire or the Arbitrators would order any test that they considered satisfactory, the Company would carry it out under the superintendence of the Local Authority.

Mr. BALFOUR BROWNE said the proposal was an exceedingly good one.

Mr. *Hawkesley*, in further cross-examination by Mr. BALFOUR BROWNE, said that he recollected the Kirkleatham case. It was, however, essentially different from the present one, as Parliament had there said that any local autnority might purchase the pipes and other fittings within their own district from another local authority who were supplying the water; and therefore the selling party were only entitled to be paid for the value of the pipes as they lay in the ground as a going concern, without anything for their power of earning. There, the Act of Parliament having directed it, he had made a structural valuation; but in this case, in his opinion the Act of Parliament did not direct it. He considered that in the present instance the Company were forced to part with their property. He was not aware that there had been negotiations at one time, but that the Local Authority had broken them off because the works were so bad. He had not been down the well; but the works above ground appeared to be in good order. He did not know that the exhaust water from the engine was flowing away, and injuring a neighbour's woods.

Re-examined by Mr. CRIPPS: He considered that a concern of this character ought to be worked, when it got to its normal condition, at 40 per cent.; and that, for purposes of capitalization, they ought to take the normal percentage as regards working expenses, and not the abnormally high working expenses of the early days of the undertaking.

Mr. CRIPPS stated that he would not go into the Kirkleatham case with witness; but that if structural value was adopted in this case, they would go to the Courts about it. This, however, was a mere matter of argument which he would deal with when he came to reply.

Witness: I concluded my evidence last evening by saying I thought there was a fallacy in the questions which Mr. Balfour Browne was putting to me with regard to the yearly tenancy.

Mr. CRIPPS: Wait till he argues that. We shall have the last word.

Mr. *F. W. Dobson*, the Secretary and Manager of the Company, in reply to Mr. CRIPPS, said he joined the Company 3½ years ago. The construction of some of the mains for which powers had been taken had been delayed, partly through want of funds, and partly because the question of purchase had been hanging over their heads for a couple of years. The first pumping test was taken on Oct. 25. They pumped for 5 hours 14 minutes, at the request of Mr. Mansergh's assistant; and there was not any breakdown of the pumps, or any other difficulty on that occasion. The second test was on Nov. 1, when Mr. Mansergh's assistant, as representing the Local Authority, was also present. When they had pumped for 11 hours 25 minutes, one of the rod-points broke at the well; it was a very old flaw in the casting. The total quantity of water pumped in the second test was 98,082 gallons. Then there was a further test, on Dec. 6 and 7; Mr. Mansergh's assistant again being present. They commenced pumping at 9.45 a.m. At 11.15, the water was down to the rest level; they having pumped in an hour and a half 29,550 gallons. Then there was some pumping at intervals until 12.54, while he and another gentleman were down the well. Then they began the actual twelve-hour test, during which time they pumped 90,000 gallons. There was no breakdown or anything of the kind; but they stopped because some dirt got in the oil, and one of the journals consequently became a little hot. They could have put water on and cooled it, and so continued the test; but at the same time the filter-bed was full, and it was desirable to run water off. After an hour's rest, they started again at 2.5 a.m., pumping with intervals up to 8 a.m.; and the journal was perfectly right then. There was no breakdown at all. Speaking as Manager, he would be only too pleased to give every facility for any further test. He was under the impression that the Company had offered a four days' test to the Council, which they had declined to accept. Witness was examined at length upon the details of the estimated additional supplies which Mr. Hill and Mr. Hawkesley had adopted in their valuations.

Witness was then cross-examined upon these details by Mr. BALFOUR BROWNE, with a view to show that, owing among other things to the existence of private wells, the additional supplies had been over-estimated. Referring to the pumping, witness acknowledged that the 24,000 gallons which were in the well when they began to pump ought not to have been counted in. It was a fact that the representatives of the Council wanted to put a cyclometer to register the number of revolutions of the engine, and that Mr. Robus refused to allow it because there was no guarantee that it was correct. On a subsequent test, however, the cyclometer was put on; but he could not say whether it was the one that had previously been objected to. He believed the level of the present reservoir was 464 feet above Ordnance datum.

Mr. BALFOUR BROWNE: Are you not aware that the outlet is 450 feet?

Witness: I have not levelled it myself.

Do you not know that Ardingley is 428 feet above Ordnance datum?—I am not aware of that.

It is 6 miles off; and if we put on 5 feet per mile of main for friction, it adds 30 feet to the 428 feet, and makes 458 feet, does it not?—Yes.

Therefore, if I am right in saying that your works are 450 feet at the outlet, at Ardingley it would be 8 feet the wrong way?—Yes; but I cannot say whether it is so or not.

Are you aware that Ardingley is one of the places that you are taking the credit for the supply of by means of your new mains?—Yes.

Mr. BALFOUR BROWNE asked for the contract and the schedule.

Mr. CRIPPS: I do not produce it, unless I see that it is material. If anything is done here in the way of basing the estimate on structural value, we shall go to the Courts.

Mr. BALFOUR BROWNE: You have threatened that already.

Mr. CRIPPS: I am not threatening.

Mr. BALFOUR BROWNE: You can conduct your case as you like. But I think that the structural value is material; and I have a right to cross-examine on my basis of this value. I am quite prepared to go to the Courts upon it.

Mr. CRIPPS: I refuse to produce the contract. That is the present position.

Witness, in reply to further questions, stated that an amount of £88 for pump-rod joints was charged to capital because the pumps were very much cut about by being used for well-sinking purposes. He would not say that was an improper use of the pumps, as they had not another then. They had now put down a sinker's pump, at a cost of from £100 to £150.

Mr. BALFOUR BROWNE: And in order to save that £100 to £150 in 1895, you spent £179, as well as the £88, gobbling up the profits. Now is it not a fact that repairs and maintenance of your works, instead of going up with increased business, have gone down in the last year?

Witness: Yes.

In 1894, there were 407 supplies; and the working expenses were £688. In 1897, there were 790 supplies; and the expenses were £15 less. You have therefore practically doubled the supply, and your working expenses are less, although up to this year they had increased. They went up to £751 in 1895, to £763 in 1896, and then down to £673 in 1897—or a reduction of nearly £100. In the year when the expenses went down so remarkably from £763 to £673, I find that you wrote off and put to capital an amount for wages of £159, and for coal and oil a sum of £232?—Yes.

Which is the largest of any year on record?—Yes; because we had been continually at work during that time.

Mr. MANSERGH: You mean in the chamber by the well?

Witness: Yes, in that adit.

Re-examined by Mr. CRIPPS: Taking the pumping test of Nov. 1, and excluding any question of the well acting as a reservoir, they obtained 74,000 gallons in ten hours' pumping, which was at the rate of 7400 gallons an hour; and on Dec. 6 and 7, taking the average of eleven hours' pumping, they obtained 7403 gallons per hour.

Mr. CRIPPS said that, in reference to the supplies to houses along the lines of proposed mains, in estimating £2·15 as the average per supply, Mr. Hill and Mr. Hawkesley had acted on the assumption that it did not include the water-closet and bath elements. This was erroneous; and of course their estimate would have to be proportionately reduced.

Mr. *E. H. Bousfield*, in reply to Mr. CRIPPS, said that the present net income of £1000 a year was fairly capitalizable on the 3 per cent. table, which, at 33¼ years' purchase, gave £33,333; and he thought it was a justifiable deduction that, with a rateable value of houses on the main of nearly £14,000, *plus* the new houses, the Company would within seven years double their present net revenue. For the first seven years, he took an immediate income of £500, and capitalized it on the 3 per cent. table at 6¼ years' purchase, which gave £3125. After the seven years, he took an increased income of £1000 a year in perpetuity on the 3 per cent. table; and, at 27 years' purchase, he thus got £27,000—giving a total on that head of £30,125 to be added to the former £33,333.

The UMPIRE: I do not understand the 27 years' purchase. I thought that you were working on 33¼ years.

Witness: That is the 3 per cent. table—33¼ years after seven years. It is deferred for seven years. Then, on the assumption that our income will increase to the extent of 100 per cent. after the first seven years, I take it that there will be a less increase in the further period of seven years, which I have put at 75 per cent. The remainder of the houses on the line of the Company's main will, I take it, come into the system; and there will be still a large number of houses built. I think it fair therefore to assume that at the end of the next seven years, and during that period, we shall accumulate a further income of £750. The mean of this is £375 for seven years; after seven years, at 5 years' purchase, £1875; and after this period of fourteen years, on the 3 per cent. table discounted, it will yield, at 22 years' purchase, £16,500—making a total under that head of £18,375.

If your anticipation is right, that at the end of fourteen years the income will be £2750, you must add the £18,375 to the two preceding figures?—Yes. I take a further period of seven years. I think that there the increase will be proportionately less. We shall have absorbed all the houses on the line of the Company's main; and the only source of income from existing houses will be those near the main, but further removed. I think that the increase at the end of 21 years may fairly be taken at half our present net income—£500 a year. This, dealt with on the same lines, gives for the term of seven years after fourteen years, a mean of £250, which is capitalizable at 4¼ years' purchase, or £1062. This increased income after 21 years, at 18 years' purchase (£9000), makes a total of £10,062; giving a grand total of £91,895. From this has to be deducted the necessary expenditure chargeable to capital account, which I take from the Engineer's estimate as £6600, in order to maintain the works in their present efficient state (if they are efficient), and to enable the Company to give a supply of water that will yield this net income. The £91,895 is thus reduced to £85,295. To this, I add the customary 10 per cent. for sale, because I understand that the Company are parting with their works under compulsion, and therefore they ought to have the usual allowance. In this usual allowance will be included the various expenses which are generally incidental to such a transaction. I thus arrive at a net total of £93,824. Looking at it

from an auctioneer and surveyor's point of view, I do not think I have in any way over estimated what you would expect to be the development of the district. I think it is an exceedingly rising place, and that it has all the elements calculated to conduce to a rise. The development of a place of this kind is very much dependent on the water supply, as people will not go and live where they cannot get good water. From my knowledge of the district, it will be in the future subject to a very large increase of population. It must increase as do other places of a like character—such as Redhill and Woking. Immediately they got their water supply, they developed to an enormous extent.

Cross-examined by Mr. BALFOUR BROWNE: The £1000 which he started with as the net annual income of the Company was a figure that was supplied to him. He had started on the supposition that it was to be doubled in seven years. The next figure he took was that 75 per cent. was to be added in fourteen years; and then that 50 per cent. was to be added at the end of 21 years. His whole valuation depended upon whether these suppositions were correct or not.

Re-examined by Mr. CRIPPS: The calculation that I applied in this matter is the same that we adopted in the cases of the bridges being taken over about twenty years ago. There was an increase anticipated, and that was dealt with on the lines which I have followed in this instance. There is no other way of dealing with it that I know of.

The proceedings were then adjourned till Tuesday, Dec. 21.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The year 1897 has now gone the way of its predecessors. If it be asked how it fared with the gas industry during the year, I think the only correct reply would be that it has more than held its own in the midst of the keener competition which now exists. Individual reports were given as they came out, and need not be repeated. But, speaking generally, they showed increased outputs of gas; and if the revenues were not in all cases increased, it was either due to reductions in the charge for gas or to diminished income from residuals. One of the chief causes of this state of matters was the moderate price of coal. To take the one item of splint, it began the year at 7s. 9d. per ton; went down to 6s. 9d. in June, about which time contracts are being looked into by gas-supplying bodies; rose in September to 7s. 9d.; and is now quoted at 7s. 3d. There has been no trouble with the miners, though an agitation was set on foot in August. It was checked by the men themselves. Consequently deliveries of coal have been more regular than is frequently the case. Other reasons for the greater consumption of gas are (probably in their proper order): The continued increase in urban populations, due to the influx into towns of residents in rural districts, for whom there is now, on account of the extensive use of machinery in agricultural workings, no employment which would induce any person who is possessed of his full bodily and mental faculties to remain on the soil; the higher taste for lighting, induced by the introduction of electric lighting, incandescent gas lighting, better quality of gas-burners generally, and even the improvement which has taken place in oil lighting; the extension of cooking and heating by gas, which, again, is one result of the lowering of the charge for gas, following upon reduced prices of material. There is now a prospect of coal rising in value, which may make the current year scarcely so profitable as that which is now closed.

Extensions were carried out during the year in the works at Edinburgh, where carburetted water-gas plant has been erected, but has not yet been taken into use; at Dundee, where new purifiers have been constructed; at Dumfries, where new mains and purifiers have been provided; at Kilsyth, where a new gasholder has been erected; at Arbroath, where also a new holder has been put up; at Perth, where a wire-rope guided gasholder, built by Ashmore, Benson, Pease, and Co., was inaugurated in June last; and at Montrose, where new purifiers were constructed. This list, which is not complete, indicates a good deal of activity for gas engineers, and, further, that the owners of gas-works have faith in the future of their undertakings.

The coming year is likely to see more activity. The Perth Gas Commission have obtained an Act of Parliament, and are about to erect altogether new works. The Edinburgh and Leith Gas Commission have purchased a site at Granton for new works, to supersede all their existing stations, and are in Parliament with a Bill to give them powers for the erection of the works. In Glasgow, the Corporation are looking out for a site for new works; the existing ones being every year getting less capable of meeting the rapidly extending consumption. They had all but secured a site of about 40 acres, near Newton, in the Rutherglen district, when it was discovered on boring that the place was undermined by old coal workings, and was therefore unsuitable for a gas-works. It was therefore abandoned.

Transfers during the year were much in evidence, but were rather a dragging business. The Stirling transfer was thrown out by a Committee of the House of Lords—a proceeding which, I take it, was the outcome, not of deliberate conviction on the merits of the question, but rather of personal antagonism among the townsfolk. There were suggested transfers at Kirkcaldy, Motherwell, and Saltcoats; but in no case did the movement go beyond the proposition stage. At Monifieth, which is a new burgh, the Police Commissioners have adopted the Burghs Gas Supply Act, with a view to the erection of gas-works—the first in the place. Limited liability companies have been registered at Bo'ness, Larkhall, and Pitlochry.

The customary meetings of Scotch gas managers were held—the Informal Meeting of Gas Managers at Glasgow in April; the North British Association Meeting at Ayr in July; and the Waverley Association Meetings at Haddington in April, and at the English town of Berwick in September. They were all interesting gatherings; but nothing very brilliant was evolved at any of them.

The year was, in fact, not distinguished for the bringing out of new discoveries. The Peebles oil-gas process has not yet been got into satisfactory working at Paisley, but is likely to be so soon. Almost as the year closes, it is announced that Mr. Foulis, of Glasgow, has had working for months an oil-gas system on much the same lines, which gives indications of going beyond what any other process has accomplished.

Of the *personnel* of those actively connected with the production of gas, the greatest change took place in Edinburgh, where Mr. R. Mitchell retired and was succeeded by Mr. W. R. Herring, of Huddersfield, who, however, was appointed Chief Engineer to the Gas Commission. Mr. Mitchell only survived his retirement for seven weeks. Mr. J. D. Smith, of Selkirk, was appointed Gas Manager at Stirling, *vice* Mr. P. Watson, retired. Mr. W. B. M'Lusky, of Kelso, was transferred to Selkirk; Mr. James Brodie went from Gorebridge to Kilmalcolm; Mr. S. Black, late of Alexandria, was appointed Gas Manager at Berwick, in succession to Mr. W. M. Ruxton; Mr. D. Easson, of Perth, was appointed Gas Manager at Maybole, in place of Mr. A. C. Young; and Mr. A. C. Young became Manager at Kelso.

Of water supply, the largest movement is in Edinburgh, where the Water Trust have let the first of their contracts for the introduction of the Talla augmentation. The Trust have also got into trouble with the Clippens Oil Company, with regard to the minerals below their pipe-track. The Glasgow Corporation are still engaged in the augmentation of their water supply from Loch Katrine.

I hasten to put myself right in a matter upon which it transpires that I was mistaken when, a fortnight ago, I wrote that the oil-gas plant in the Dawsholm Gas-Works at Glasgow was not working. I have a note from Mr. Foulis, in which he says that one section of the plant was in full operation at the time of my visit, and that the other section, which had been off for repairs, was put into action the next day. He adds: "The apparatus works so quietly and automatically that it is not surprising you thought it was standing idle." This shows the marvellous nature of the plant. That it was heated up was quite apparent; but there was no attendant near it, and there was neither movement nor noise. It was, to all appearance, standing idle while the attendants were absent. It is difficult to conceive of this in any other light than that it is about as near perfection in gas making as it is possible to get.

At the monthly meeting of the Edinburgh and Leith Gas Commissioners, on Monday, the report by Mr. W. R. Herring, the Engineer, showed that during November there was an increase of 5,270,000 cubic feet in the output of gas as compared with November of last year, and that for the period from May 16 the total increase had been 29,275,200 cubic feet. Mr. John Jamieson said that the increase was not so great as last year; and he believed this was accounted for to some extent by the fact that the weather had been exceptionally clear till lately. The Engineer had found that the increase had been greater at the hours at which they might presume gas-stoves would be in use. The increase was not so great in Edinburgh as it was in Leith, which might be due to the electric light having been so much taken up in the former place. Altogether, he thought that they might look upon matters in connection with the production of gas as very satisfactory. With regard to the complaint by a large ratepayer, that the Commissioners had made a subscription of £250 to the Diamond Jubilee Fund, Messrs. Scott and Paterson, C.A., wrote, in reply to a request to know who the complainer was, that he was a large ratepayer in the city. Mr. Gibson moved that unless the name were disclosed, no further notice be taken of the matter. This was agreed to. Major Christian, of Portobello, wrote stating that he understood a section of the Commissioners still refused to give residents in Duddingston Parish common justice regarding the price charged for gas, and that he would very much like to know the reason, and what interpretation was put upon clauses 65 and 79 of the Commissioners' Act of 1888. He could not, he said, go on protesting every time an account was presented to him; and the only way he could see was for the Commissioners to give them gas at the price charged in the city, or to take the case to a Law Court. Another matter, the writer said, was that when the rate of 4s. was laid on, it was not entered in the minutes, nor did the majority of the Commissioners know anything about it; whereas clause 15 of the Act declared that entries of all proceedings should be made in a book provided for the purpose. Was this, he asked, a legitimate way of carrying out the Act, or did the Commissioners ignore Acts that were inconvenient or offensive? Mr. Gibson thought it was quite irregular to catechize the Commission in this way. The letter should be sent to the Works Committee, to be considered along with the motion on the same subject. This was agreed to. Mr. Herring is to report as to the extra charge which should be made for gas supplied to persons resident outside the boundaries of Edinburgh and Leith. The Commissioners have purchased £60 10s. 6d. of annuities for £1822 13s. 6d. This is at the rate of 30 years' purchase, and is a stiff price. The Commissioners, out of £34,000 of annuities issued, have redeemed £334 10s. 6d., at a cost of £10,119 19s. 6d.

That perennial source of dissatisfaction in most places, the opening up of newly-paved streets, is attracting some attention in Edinburgh at present. The proposal is made to have a species of Joint Board, composed of representatives of the Town Council, the Gas Commission, the Water Trust, and the Electric Light Committee, who would direct all matters relating to the opening of streets. This is a subject upon which finality need never be looked for. There always will be occurring, now and again, instances in which newly-paved streets will be spoiled by the pipe-laying of some of the statutory bodies in the place. To reduce these to a minimum is the object of the very many who have taken up this question. I fear the Joint Board is not the solution of the problem yet. Interference with the fixed estimates for the year of the various bodies would be the chief difficulty in the way of the Board. The disposition is to throw the blame upon the body who cuts up the street; but I rather think it ought to rest upon the road authorities. Gas or water committees cannot rush to lay a main on a few weeks' notice. They must conduct their business according to a scheme of finance agreed upon and fixed for the year. They ought, therefore, never to have less than twelve months' notice of the intention of the road authorities to pave; and for that matter, there can be nothing which should prevent the road authorities giving even two years' notice of the streets they propose to deal with. If this were done, the gas or water committees would have time to inquire into the condition of their mains, and to adjust their finances so as to meet any expenditure which might be necessary.

The plans for the new gas-works at Perth have been approved by the Works Committee of the Gas Commission. It is not before time, for the existing works are getting positively dangerous. They are not capable of producing, with safety, the quantity of gas which they are required to. The effect of this was seen on the morning of the 24th ult., when, at 3 o'clock, a workman observed that a fire had broken out in the retort-house. Oil or tar had overflowed; and of course its ignition was only a

matter of time. The flames spread quickly, and were with difficulty extinguished. Water had little effect upon them, and sand had to be employed. A portion of the roof of the retort-house was destroyed, and the plant in it damaged; the total loss being estimated at about £200.

The Forfar Gas Corporation, apparently not having sufficient to occupy their full energies in the legitimate management of their business, have taken upon themselves the task of regulating the rates of wages to be paid by tradesmen in the town. The movement is the old one of inserting a clause into all contracts, to the effect that the contractor must pay all his workmen the standard rate of wages, and work in accordance with the recognized bye-laws of the different Trades Unions. Such motions are usually made in the professed interests of the workers; but the effect is not always such. I know an instance where a bridge had to be painted—a large job—and the contractor was tied down by the Corporation to pay the standard rate of wages. Well, he did so; but, instead of employing painters at 8d. or 9d. an hour, he took on labourers, and while paying them the standard rate of wages, he made more profit under the clause than he would otherwise have done. Such incidents as these are lost upon the class of person who act at the behest of the Trades Union element in the community. In Forfar, the gentleman who brought the subject forward admitted that he did so because he had received a communication from representatives of Unions. I recollect the time when, in most corporations, such an attempt to dictate to the authorized representatives of the community would have been rejected without remark. Instead of doing this, and preserving their independence, the Forfar Gas Corporation adopted the motion. They did so, however, with the least possible amount of giving way to outside interests; for it was only by the casting vote of the Provost that it was carried.

The Arbroath Gas Corporation have had completed the construction of a new gasholder, as part of a scheme of proposed extensions. It is reported that during the past financial year they made a profit of £1038 in the working of their new sulphate plant.

On Sunday morning, it was discovered by the keeper of one of the reservoirs in connection with the Aberdeen Water Supply, that paraffin oil was coming in from the aqueduct. The discovery was a disquieting one, as it showed the faulty nature of the aqueduct. This was found to be the case. The paraffin came from a cask in an outhouse about eight miles from the city. The inference is that, if paraffin oil can get into the water supply, so may other impurities. An inspection of the aqueduct is to be made, to ascertain if it be specially faulty at the place. The oil which found its way into the reservoir was easily got rid of. The reservoir was filled to overflowing; and the oil ran over the waste-weir.

Companies Wound Up in 1897.—The list of undertakings wound up last year is a very short one, so far as readers of the "JOURNAL" are concerned. The Pará Gas Company and the Wickless Oil-Lamp and Gas Economizer Syndicate were wound up voluntarily; and Crossley Brothers and the Incandescent Fire-Mantel and Stove Company were wound up with a view to continued existence in another form.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 1.

Sulphate of Ammonia.—The week has been somewhat broken by holidays; and prices have been barely maintained—the closing quotations being £9 per ton f.o.b. Hull, and £9 to £9 2s. 6d. per ton f.o.b. Liverpool and Leith. A fair amount of buying has been done, though December requirements were as far as possible covered before the holidays; and full prices have been paid in the case of urgent orders. Direct business has been limited; consumers hoping for easier prices with the New Year, though there does not seem to be much ground to build upon beyond what speculators may be able to do in the way of damaging the market. In the forward position, London has again been done at £9 2s. 6d. per ton, Beckton terms, January-April delivery, and £9 5s. per ton is now required. For delivery over the spring months, f.o.b. Leith, makers ask £9 7s. 6d. per ton; but this price seems rather above buyers' ideas.

Nitrate of Soda.—There is a better tone in the nitrate of soda market; and the statistical position would seem to point to an advance. But spot prices meantime remain 7s. 6d. per cwt. for good, up to 7s. 7½d. per cwt. for fine, quality.

LONDON, *Jan.* 1.

Tar Products.—There is no change for the better in this market, in respect to either benzols or pitch. Both continue flat and unsaleable. In regard to benzols, the position is intensified by the continuous reports of larger quantities being put upon the market from coke-ovens in Germany, Belgium, and elsewhere. The price, however, has now reached such a low figure that it will doubtless secure the attention of gas producers who formerly used it largely for enriching gas; and, at anything like the prices at which benzol is now obtainable, it is the cheapest agent for carburetting purposes. Interested parties are undoubtedly magnifying the production of benzols, with a view to depressing its value. The fact, however, that makers have no stocks, and that consumers are also working from hand to mouth, makes the position appear as if it were the result of clever market operations. Creosote enjoys a steady market; and large contracts for the ensuing six months have been made at prices quoted below. Carbolic acid is firm. Naphthas are slack, with no business doing. Naphthalene is moving better; and it is felt that with the turn of the year, most tar products will see a better market.

Average market prices are as follows: Tar, 13s. to 17s. 6d. Pitch, 15s. to 18s. 6d. Benzols, nominal, 90's, 1s. 5d.; 50's, 1s. 6d. Toluol, 1s. 9d. Solvent naphtha, 1s. 7d. Crude, 30 per cent. naphtha, 7½d. Creosote, 2½d.; liquid, 2¼d. Heavy oils, 40s. to 50s. Carbolic acid, 60's, 2s. Naphthalene, 50s. to 60s.; salts, 30s. Anthracene, "A," 5½d.; "B," 4d. to 4½d.

Sulphate of Ammonia is firmer. A capital business is being done; and the demand for forward delivery is of an important and pressing character. Sulphate, having done so well for agriculturists during the past year, has no doubt a good deal to do with this better position. £9 to £9 5s., less 3½ per cent., according to port of shipment, is to-day's value.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST

Referred to on p. 18.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 14	10½	Alliance & Dublin 10 p. c.	24—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	16¼—17½	..	4 5 8
300,000	100	July 1	5	Australian 5 p. c. Db.	107—109	..	4 11 9
200,000	5	Nov. 11	6½	Bombay, Ltd.	6⅞—7¼	..	4 9 7
40,000	5	,,	6½	Do. New, £4 paid	5—5½	..	4 14 6
380,000	Stk.	Aug. 27	12	Brentford Consolidated	300—305	..	3 18 8
240,000	,,	,,	9	Do. New	227—232	..	3 17 7
50,000	,,	,,	5	Do. 5 p. c. Prf.	145—150	..	3 6 8
159,375	,,	Dec. 15	4	Do. 4 p. c. Db. Stk.	134—138	..	2 18 0
220,000	Stk.	Sep. 15	11½	Brighton & Hove Orig.	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A. Ord. Stk.	200—205	..	4 2 11
933,500	Stk.	Aug. 27	5	Bristol, 5 p. c. max.	130—135	..	3 14 1
420,000	20	Sep. 30	11½	British	56¼—57½	..	3 18 3
50,000	10	Aug. 27	11½	Bromley, Ord. 10 p. c.	25—27	..	4 5 2
71,000	10	,,	8½	Do. 7 p. c.	20—22	..	3 17 3
500,000	10	Oct. 14	6	Buenos Ayres (New) Ltd	9¼—10	..	6 0 0
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	97—99*	+1	4 0 10
150,000	20	July 15	8½	Cagliari, Ltd.	30—32	..	5 3 1
100,000	10	Sep. 30	8	Cape Town & Dis., Ltd.	16½—17½	..	4 11 6
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	59—61	..	4 18 5
550,000	Stk.	Oct 14	13½	Commercial Old Stock	340—345	..	3 18 3
196,483	,,	,,	10½	Do. New do.	255—260	..	4 0 9
196,309	,,	Dec. 15	4½	Do. 4½ p. c. Db. dc.	154—157	..	2 17 4
800,000	Stk.	Dec. 15	12	Continental Union, Ltd.	250—255	..	4 14 1
200,000	,,	,,	9	Do. 7 p. c. Prf.	213—218	..	4 2 7
51,600	Stk	Aug. 27	14	Croydon A 10 p. c.	315—320	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	252—257	..	4 5 7
535,000	Stk.	Aug. 12	5½	Crystal Palace Ord. 5 p. c.	138—142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Prf.	140—143	..	3 9 11
486,090	10	July 29	11	European, Ltd.	26—27	..	4 1 6
354,060	10	,,	11	Do. £7 10s. paid	18½—19½	..	4 4 7
5,896,590	Stk.	Aug. 12	12¾	Gaslight & Coke, A, Ord.	314—317	..	4 0 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	113—118	..	3 7 10
665,000	,,	,,	10	Do. C, D, E, 10 p. c. Prf.	320—325	..	3 1 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	222—227	..	3 6 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	204—209	..	3 7 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	319—324	..	3 1 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	Dec. 15	4	Do. 4 p. c. Db. Stk.	138—141	..	2 16 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	155—158	..	2 16 11
908,000	,,	,,	6	Do. 6 p. c. do.	205—210	..	2 17 1
70,000	10	Oct. 28	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	Nov. 11	10	Imperial Continental	218—223	−3	4 9 8
376,400	100	Aug. 3	4	Do. 4 p. c. Dbs. Red.	99—102	..	3 18 5
473,600	Stk.	Aug. 12	3½	Do. 3½ p. c. Db. Stk.	104—107	..	3 5 5
					* Ex div.		

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Dec. 15	6	Malta & Medn., Ltd.	5½—6	..	5 0 0
560,000	10	Oct. 1	5	Met. of Mel- bourne 5 p. c. Db.	112—114	..	4 7 8
					4½ p. c. Db.	109—111	..	4 1 1
250,000	100	,,	4½				
541,920	20	Nov. 11	5	Monte Video, Ltd.	14½—15½	..	6 9 0
150,000	5	Nov. 26	8	Oriental, Ltd.	8—8½	..	4 14 1
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7½	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—2	..	4 0 0
60,000	5	Sep. 30	7	Ottoman, Ltd.	4½—5	..	7 0 0
420,000	100	Nov. 2	6	People's Gas 1st M. Bd.	104—109	..	5 10 1
500,000	100	Dec. 1	6	of Chicago 2nd do.	103—108	..	5 11 1
250,000	10	Sep. 30	10	San Paulo, Ltd.	16—17	..	5 17 3
135,000	Stk.	—	10	Sheffield A.	250—253	..	3 19 0
209,053	,,	—	10	Do. B.	250—253	..	3 19 0
447,427	,,	—	10	Do. C.	250—253	..	3 19 0
5,475,000	Stk.	Aug. 12	5½	South Metrop., 4 p.c Ord	143—146	..	3 11 11
1,416,667	,,	July 15	3	Do. 3 p. c. Db. Stk.	106—109	..	2 15 0
60,000	Stk.	Sep. 15	12	Tottenham and Edmonton A.	285—295	+5	4 1 4
60,000	,,	,,	9	Edmonton B.	205—215	..	4 3 9
182,380	10	Dec. 30	7	Tuscan, Ltd.	134—142*	+½	4 16 7
149,900	10	July 1	5	Do. 5 p. c. Dbs. Red.	102—105	..	4 15 3
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	333—338*	+1½	3 2 2
150,000	,,	,,	5	Do. 5 p. c. Prf.	177—180*	+2½	2 15 6
160,000	,,	,,	4½	Do. 4½ p.c. 1 f. Stk., 1875	157—160*	+2¼	2 16 3
175,785	,,	Sep. 30	4½	Do. 4½ p. c. Db. Stk.	160—165	..	2 14 6
1,720,560	Stk.	Oct. 14	7½	East London, Ord.	232—236	..	3 3 8
654,740	,,	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	162—165*	+1½	2 14 6
390,000	,,	,,	3	Do. 3 p. c. Db. Stk.	105½—106½*	+½	2 16 4
700,000	50	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	122—127	..	2 19 0
295,000	Stk.	,,	4	Do. 4 p. c. Db. Stk.	147—152	..	2 12 8
708,000	Stk.	Aug. 12	13	Kent	362—367	..	3 10 10
160,000	,,	,,	7	Do. New, 7 p. c. max.	215—220	..	3 3 7
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max.	303—308*	+1	3 4 10
406,200	100	,,	7½	Do. 7½ p. c. max.	225—230*	+1½	3 5 2
350,000	Stk.	Sep. 30	4	Do. 4 p. c. Db. Stk.	147—150	..	2 13 4
500,000	100	Aug. 12	13	New River, New Shares	450—455	..	2 17 1
1,000,000	Stk.	July 29	4	Do. 4 p. c. Db. Stk.	152—155	..	2 11 7
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	164—167	+1	3 11 10
126,500	100	,,	6	Do. do. 7½ p. c. max.	155—160	+3	3 15 0
489,200	Stk.	,,	5	Do. do. 5 p. c. Prf.	175—180	..	2 15 6
1,019,585	,,	Oct. 14	4	Do. 4 p. c. A Db. Stk.	144—147	..	2 14 7
1,155,066	Stk.	Dec. 15	10	West Middlesex	315—320	..	3 2 6
200,000	,,	,,	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 7
					* Ex div.		

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The usual stoppages for the New Year holidays, which in this district will extend over three or four days, are interfering with ordinary operations; and as regards business, there has been only a quiet demand, also as a result of the holidays. Generally, however, prices remain without quotable change. Best Wigan Arley averages 10s. 6d. to 11s. per ton at the pit; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coals, 7s. to 7s. 6d. In the lower descriptions of fuel for iron-making, steam, and general manufacturing purposes, a steady position is maintained. Steam and forge coals are firm at about 6s. 6d. per ton at the pit as the minimum for inland sales; while for shipment, there is no difficulty in getting about 8s. 3d. for good qualities of steam coal delivered at the ports on the Mersey, and 8s. 6d. on the Manchester Ship Canal. Engine classes of fuel are in fairly good request; and it is only in some of the inferior sorts that there is any pressure of surplus supplies on the market. For contracts, however, prices are still on a low basis; common slack being obtainable at about 3s., medium sorts at 3s. 9d., and best qualities at 4s. 6d., with quotations for current sales on small quantities about 6d. per ton above these figures.

Northern Coal Trade.—Now that the holidays are over, the coal trade may be expected to resume its normal condition, after being disturbed for the past week by the increased demand and the diminished production. The collieries have worked rather irregularly, and will possibly do so for a day or two longer; but after that, the supply will increase with steadiness. Best Northumbrian steam coals are now about 8s. 3d. per ton f.o.b.; second-class steam coals, 7s. 6d. to 7s. 9d.; and steam smalls, 3s. 3d. Manufacturing coals are quiet; and the tendency is rather to lower prices. Occasional cargoes of gas coal command high prices—as much as 8s. 3d. per ton f.o.b. being asked. No additional contracts have been placed of late. The price of gas coke is unaltered this week.

Scotch Coal Trade.—The market closed for the year with a firmer tone than it exhibited during the greater part of the period. Splint is particularly in request, mostly for iron-works, though gas-works are responsible for a large consumption. Inquiries are being made for the current year's contracts; and while business has not actually been done, the feeling of coalowners is that they are likely to get better prices than last year. The rates quoted are: Main, 6s. 9d. to 7s. per ton f.o.b. Glasgow; ell, 7s. 3d. to 7s. 6d.; and splint, 7s. 6d. The shipments for the week amounted to 165,113 tons—a decrease on the previous week of 2138 tons; but an increase over the corresponding week of last year of 6792 tons. For the year (the last few days not being included), the total shipments have been 8,099,374 tons—an increase over the previous year of 499,874 tons.

The Gas-Meter Testing Work of the London County Council.—The London County Council are erecting in Rosebery Avenue a large building to be used as a gas-meter testing station for the northern districts of London; and it is expected to be ready in March or April next. The work of the Council in this important department has increased very considerably of late years, owing to the introduction of penny-in-the-slot meters. Some idea of its extent may be gathered from the fact that during the financial year 1896-7 no fewer than 202,913 meters (of which 18,521 were disputed) were dealt with by the Council's officials at Shoreditch, Southwark, and Westminster. Of these as many as 21,068 were rejected, and 180,253 were stamped. The fees received in payment amounted to no less than £6495 13s. 6d., which more than covered the annual expenses.

Extensions at the East Cowes Gas-Works.—The need for additional storage having for a long time been felt at the East Cowes Gas-Works, a larger holder has been erected and brought into use; the ceremony of turning the gas into the town having been performed by Mr. R. Fish, Assoc.M.Inst.C.E., the lessee of the works. The holder is in two lifts, respectively 43 ft. 6 in. and 45 feet in diameter, and each 16 feet deep. The capacity of the holder is 50,000 cubic feet. The total weight of iron-work is 45 tons. The tank is 46 ft. 6 in. in diameter, and 16 feet deep; and the contract has been successfully carried out by a local firm under the supervision of Mr. Fish, the designer. In addition to the gasholder, two more purifiers, 10 feet square, have been erected, and a new traveller and lifting gear. With these improvements, the works are in a very efficient condition and capable of meeting not only present demands but those which are expected in the near future.

The Cost of the St. Anne's-on-the-Sea Gas Bill.—The subject of the costs in connection with the promotion of the St. Anne's-on-the-Sea Gas Bill was again before the District Council at their last meeting. It arose on a letter received from the Parliamentary Agents. It appeared that the disbursements had amounted to £1657, and the Council had paid £1100 odd; leaving a balance of £557 16s. 5d. The Agents stated that the Taxing Master, as a rule, did not tax bills unless the Agents produced the receipts. Supposing the Council could not remit the whole of the balance, if they would send a cheque for £250 (which, with the £500 previously sent, would cover Counsel's fees), they would themselves find the £307 until next year. If this amount was not forwarded, they would have to withdraw the accounts from the Taxing Master. Mr. Harker said the arrangement he came to soon after the Bill was lost was that the Agents would be perfectly satisfied if one-half were paid this year and the other half next. Mr. Nutter said the arrangement must have been a genuine one, as only half of the costs had been provided for in the estimates. Several members agreed that it would be a good thing if the payment could be held over as arranged; and eventually the Clerk was requested to write to the Agents, regretting the Council's inability to comply, and hoping to pay off the whole of the balance in the next financial year. It appears that these costs will prove a heavy burden to the ratepayers. As a rate of 1d. in the pound realizes just about £100, it will require a rate of 2s. 11d. to discharge the costs, which came to something like £3500.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected during the last four-and-a-half years, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

AMERICA.

TORONTO	One New Set.
OTTAWA	One New Set.
TORONTO	(Second Contract) Improving Four Double Superheater Settings.
LINDSAY	Re-modelling Plant.
MONTREAL	Two New Sets and other parts of Plant.
BELLEVILLE	One "Springer" Setting Re-modelled with M-W-P. Patents.
OTTAWA	(Second Contract) One New Set.
BRANTFORD	Additional Improvements to Existing Setting.
ST. CATHERINES	Additional Improvements to Existing Setting.
KINGSTON, PA.	One New Set and other Parts of Works, including New Purifiers and Gasholder.
PETERBOROUGH	One Set and Re-modelling Works.
WILKESBARRE, PA.	Two New Sets and other parts of Plant.
ST. CATHERINES	(Second Contract) One New Set.
BRANTFORD	(Second Contract) One New Gasholder.

ENGLAND.

	Daily Capacity. Cubic Feet.
BLACKBURN	1,250,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
WINDSOR STREET WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Company)	120,000
SALTLEY WORKS, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR STREET WORKS BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000

Sales of Shares.—At a recent sale by auction, twelve original £25 shares in the Frome Gas Company were sold at prices ranging from £58 5s. to £61. At Lichfield on Christmas Eve, Messrs. Winterton and Sons sold by auction 100 "B" shares in the local Gas Company, at prices ranging from £15 15s. to £17 5s. per share. Last Wednesday, Messrs. Bishop and Pritchett sold £3000 of new ordinary stock of the New Swindon Gas Company. It was offered in lots of £20, £30, and up to £100; the prices realized per £10 of stock being from £11 10s. to £11 16s. Several lots of original stock, bearing 10 per cent. dividend, were disposed of at the same time, and fetched £2 10s. per £1 share. On the following day, 400 ordinary £10 shares in the Bromley Gas Company, bearing a dividend of 8½ per cent., were disposed of at prices varying from £22 to £22 10s. each.

Cromer Gas Company.—The annual general meeting of this Company was held last Thursday, when the Directors reported a profit on the year's working of £865, as against £810 in 1896—being an increase of £55. This added to the balance brought forward made the total of the profit and loss account £1163. After payment of bank interest and interest on the debentures, there was a balance of £940, out of which the Directors proposed to pay 7½ per cent. per annum, free of income-tax, on the "A" shares, 7 per cent. per annum on the "B" shares, transfer to the reserve fund £100, and carry forward £325. The report was adopted. The Company are extending their works by adding a lift to the gas-holder, and putting in a boiler and exhauster, new purifiers, station meter, &c.; and in order to provide for the cost of this work, the remaining capital authorized by the Company's Provisional Order has been issued. The shares were offered at a premium of £1 10s. each; and they have all been taken up.

Loanda Gas Company, Limited.—The fourth ordinary general meeting of this Company was held last Thursday, at the Offices, New Broad Street, E.C.—Mr. A. Fairlie in the chair. The Manager and Secretary (Mr. A. F. Baillie) read the Directors' report, which stated that the city of St. Paul de Loanda was illuminated with gas on the 17th of July last, amid great rejoicings. There was a ball in the evening; and the festivities lasted two days. The Municipal Council had already requested that the number of lamps should be increased from 700 to 1100; and the Directors were advised that it would be necessary in the immediate future to nearly double the supply of gas in order to meet all requirements. The Board at once saw that the present capital would be insufficient for providing extra plant and material, and maintaining at Loanda a constant supply of coal; and the shareholders resolved that the capital should be increased from £50,000 to £70,000 by the creation of 2000 additional shares of £10 each. It was further resolved to approach the debenture-holders, and to request their assent to the issue of an aggregate sum of £60,000 of 5 per cent. debentures in lieu of the first issue of £40,000 of such debentures; and the majority had signified their assent. The Company took over the works and their administration as from Sept. 17 last; and the accounts up to that date would be submitted to the shareholders early in the present year. Steps would also be taken immediately to appoint a duly-qualified representative of the Company at Loanda. The report was adopted.

Improvements in the Gas Distribution System at Oldham.—On the recommendation of their Superintendent (Mr. Arthur Andrew), the Gas Committee of the Oldham Corporation have decided to carry out some extensive alterations in the distribution system, in order to improve the supply of gas to certain districts, at an estimated cost of £6300.

Reductions in Price.—The Directors of the Bristol Gas Company have decided to make a uniform additional charge of only 2d. per 1000 cubic feet in the price of gas supplied in the districts beyond the boundary of the enlarged borough, as compared with the city rate, which is now 2s. 4d. per 1000 cubic feet. This will mean a reduction of 4d. per 1000 cubic feet in the Westbury and Shirehampton districts and that part of Avonmouth which is not included in the city. The price of gas at Chesterton has been reduced 6d. per 1000 cubic feet from the 1st inst. The Directors of the Cromer Gas Company have reduced the price of gas from 4s. 2d. to 4s. per 1000 cubic feet as from the 1st of October last. The West Kent Gas Company have notified their intention of reducing the price of gas for public lighting in the Lamorbey Ward of Bexley from £3 3s. to £3 1s. per lamp.

New Joint-Stock Companies.—The Electroid Gaslight Syndicate, Limited, has been registered with a capital of £50,000, in £1 shares, to carry on the business of an electric light and electroid gaslight company, with power to supply gas. The Lighting Patents Syndicate, Limited, with a capital of £5000, in £1 shares, will acquire, own, and work any patents connected with lighting by incandescent gas, oil, or other means. The Economic Acetylene Gas Generator Syndicate, Limited, has been formed, with a capital of £5000, in £1 shares, to acquire, own, and work any patents connected with generators for acetylene and other gases, gas-burners, gas enrichers and purifiers, &c., and to enter into an agreement with J. Wood and W. W. Clark. The Shoeburyness Gas Company, Limited, with a capital of £10,000, in £5 shares, will supply gas, lime, coal, coke, tar, &c., in the urban district of Shoeburyness and elsewhere. The Patent Gas Enrichment Syndicate, Limited, has been registered with a capital of £20,000, in £10 shares, to "acquire, own, and work certain undescribed patents relating to the enrichment of gas." The following new joint-stock companies have also just been formed: Austrian Incandescent Share Company, Limited, with a capital of £320,000, in £1 shares, to adopt and carry into effect an agreement made between a Company with a similar title (incorporated in 1895) and the Liquidator thereof and the present Company, for the acquisition, by purchase or otherwise, of the business and undertakings of the old Company. The Incandescent Gas-Light Company, Limited, are the first Managers. Incandescent Fittings Company, Limited, with a capital of £1500, in £1 shares, to acquire and carry on the business of importer of, and dealer in, requisites for incandescent gas lighting, carried on by H. Tossell, at 33, Jewry Street, London, E.C. Elie and Earlsferry Gas Company, Limited, with a capital of £3050, in 50 preference shares (4 per cent.) of £10 each, and 1700 ordinary shares of £1 10s. each, to carry into effect certain agreements for the acquisition of the Elie and Earlsferry Gas Company, and to carry on the same. Baku Oil Company, Limited, with a capital of £30,000 in £1 shares, to produce, refine, store, supply, and distribute petroleum and petroleum products.

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Prices, Stove Enamelled.

1485, 45s.; 1487, 55s.; 1489, 65s.

Tiles extra.

Gas Stokers' Wages at Lancaster.—In response to a petition from the stokers employed at the gas-works, the Lancaster Corporation Gas Committee have resolved to increase their wages from the present rate to 5s. per shift, with time-and-a-half for Sunday work. They were, however, unable to accede to a further request for the appointment of coke wheelers. It was explained by Mr. Helme, at the last meeting of the Council, that, by their recommendation, the wages of stokers would be increased, throughout the seven shifts, from £1 16s. 5d. to £1 17s. 6d.

Improvements at the Bolton Gas-Works.—During the past year, new plant has been established at the Bolton Corporation Gas-Works which will have a beneficial effect on the working. At the Gas Street station, manual labour has to some extent been displaced by the adoption of Arrol-Foulis charging and drawing machines, actuated by hydraulic power. These have necessitated the provision of further steam power; and the boiler-house has been extended, and another boiler fixed. At the Lum Street works, hydraulic power has been brought into action for haulage purposes. The distribution system has also received attention —several lengths of new mains having been laid, and a number of small ones replaced by others of larger diameter.

Staines and Egham District Gas Company, Limited.—The annual general meeting of this Company was held on the 17th ult.—Mr. J. Coppen in the chair. In moving the adoption of the report, he stated that there had been an increase of upwards of 8 per cent. in the sale of gas as compared with the preceding financial year, as the result of the more general use of gas-stoves for cooking and warming purposes; the demand for these appliances having been 20 per cent. in excess of 1896. In every instance they had given satisfaction. The productive power of the works had been increased from 96 retorts in 1894-5 to 152 now; and when the new washers and scrubbers which it was intended to put up were finished, he thought the Company would possess one of the best-equipped works for their size which it was possible to have. The Manager (Mr. T. Webb) reported that they were now in excellent order. As showing the care displayed in the distribution of the gas, he might mention that their loss was only 5 per cent., as compared with an average of 10 per cent. in the case of similar companies. The economy exercised in working enabled the Directors to send out 16-candle gas, while their Act of Parliament only required them to supply 14-candle. The report was adopted. Dividends of 13¼ and 10¼ per cent., less income-tax, were then declared on the original and new shares respectively. At the suggestion of the Chairman, the Manager (who has just completed his quarter of a century's service with the Company) gave a short sketch of the progress of the undertaking. He said that when he took up his duties the dividend declared, though not actually earned, was 4 per cent. on a capital of £16,000; and the price was 5s. 6d. There were then in use 37 retorts, and the works were in a very dilapidated state. They had since been remodelled, and the mains relaid and extended. The capital was now only £25,500, the price was 3s. 2d., and the dividends were 13¼ and 10¼ per cent. He thought that while the Board and the officers co-operated heartily, as they did, there was a big future for the Company. The thanks of the meeting were given to the Secretary (Mr. J. A. Engall) and to the Chairman, and the proceedings closed.

Fatal Gas Explosion at Leicester.—A serious explosion of gas occurred on Saturday evening at the house of Mr. Fowler, a solicitor at Leicester, which resulted in the death of Miss Rose Murden, a trained nurse. She had occasion to go to the larder; and, a leakage of gas having occurred, directly she lighted a match a violent explosion took place, tearing up the floor of the drawing room, and wrecking all the furniture in it. Miss Murden was thrown with great force against the wall, and sustained a fractured skull. She died almost immediately.

Electricity v. Gas for Workhouse Lighting.—At the meeting of the Ipswich Board of Guardians last Friday, the Workhouse Erection Committee reported upon the question of lighting the new Workhouse. They submitted estimates for gas by the Welsbach system and electricity; the former being £278 3s. 6d., and the latter £206 14s. But after allowing interest on the greater initial outlay for electricity, the difference in its favour was £26 12s. 6d.; and the Committee recommended this system. A communication had been received from the Engineer and Secretary of the Gas Company (Mr. J. T. Jolliffe), accompanied by a revised estimate for gas lighting and some criticisms of the Committee's figures. The new estimate provided for gas at £213 3s. 6d., or with renewals and interest £256 7s. 6d.; giving with 364 burners of varying power a light of 8120 candles; and Mr. Jolliffe's calculation for the annual cost of electricity was £325 8s. 6d., instead of £206. Adding the interest and sinking fund brought it up to £469 14s. 9d. The subject was discussed at some length, and eventually the voting was equal—four lady members of the Board giving their support to gas. The question was only decided by the casting vote of the Chairman, who was in favour of electricity.

The Cowes Gas-Works Transfer.—At their last meeting, the Cowes District Council had before them the following recommendations by the Special Gas Committee relative to the purchase of the gas-works: That a cheque be drawn for £54,587 to pay the amount of the award for the undertaking and the costs of the Company's Act, that the deeds be deposited with the Capital and Counties Bank to secure the advance of the money, and that arrangements be made to take up a permanent loan as soon as possible. In moving the adoption of the recommendations, the Chairman of the Committee (Mr. G. Fellows) alluded to the exaggerated reports which had been circulated in the town with regard to the liability which had been incurred by the Council through the purchase of the works. Having pointed out that the profits of the Company had increased since the Council resolved that the works should be purchased, he said it was estimated that the annual repayment of principal and interest on the loan for the first ten years would be £2607, which, at the expiration of that time, would be reduced by £98 7s. 6d.—the amount of principal and interest on the cost of the Company's Act, the loan for which would be borrowed for ten years. The remainder of the loan would be for 40 years altogether. On the other side, he reckoned that the profits of the undertaking at present were about £2000; and there would be the saving of the Directors' fees (£100 a year) and other sums. With the lighting of the town by gas (oil-lamps being at present used), they would make up an income estimated at £2700, or nearly £100 more than the annual expenditure. The motion was unanimously carried.

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Fatality at the Rotterdam Gas-Works.—A brief telegram despatched from Rotterdam, through Reuter's Agency, on the 29th ult., recorded a serious accident at the municipal gas-works in that city, by which three workmen were asphyxiated by "inhaling the vapour of sulphuric acid." No particulars are to hand; but it may be concluded that the fatality was in some way connected with the sulphate of ammonia plant.

The Yeovil Corporation and the Gas-Works.—At a meeting of the shareholders of the Yeovil Gas Company held on the 21st ult. for the purpose of further considering the promotion of a Bill applying for powers of incorporation, a letter was read from the Town Clerk, repeating the Council's offer of £48,000 for the gas-works. The opinion was generally expressed that the property was worth more than the Council offered. The Chairman (Mr. E. L. Whitley) proposed a resolution to the effect that the Bill as deposited be proceeded with, and it was unanimously agreed to; the offer of the Council being equally unanimously rejected.

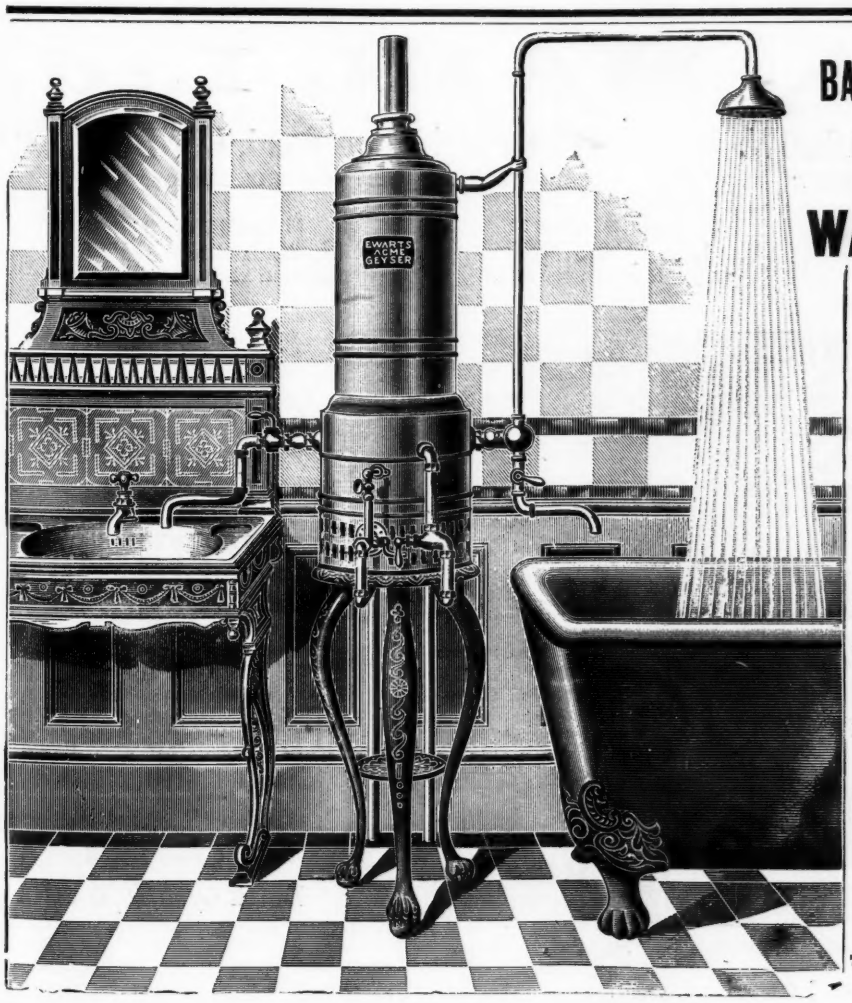
Extension of the Carburetted Water-Gas Plant at Southend.—In our issue for Jan. 5 last year, reference was made to the decision of the Directors of the Southend-on-Sea Gas Company to adopt carburetted water-gas plant. The installation was entrusted to Messrs. Samuel Cutler and Sons, of Millwall, London, and we now learn that, after a season's experience with the plant, the Directors have decided to duplicate it, in order to meet the rapidly increasing demands of their district. The order for the extension has been again placed with Messrs. Cutler and Sons; and it includes the several improvements patented by the firm.

A Water Scheme for the Whaley Bridge District.—Messrs. Sterling and Swann, of Chapel-en-le-Frith, have completed a scheme for a joint water supply for the district of Whaley Bridge. The districts for which it is proposed to provide are Whaley Bridge, Taxal, Fernilee, Newtown, and a small portion of Chapel-en-le-Frith and Disley, with a population of 7000, the requirements for which, at 25 gallons per head per day, will be 175,000 gallons. The reservoir, which is to be of not less capacity than 12 million gallons, is to be constructed in Taxal Woods, at such an altitude as will furnish a supply to any house within 2½ miles. The approximate cost of the scheme is £26,033. Should New Mills withdraw from the scheme, it would have to be greatly reduced, the cost of the lesser scheme being estimated at £13,144.

The Water Question at Deal.—The Local Authorities of Deal and Walmer and the Deal Water Company concluded their arrangements for the purchase of the water-works on the 24th ult., when, a temporary loan having been obtained from the National Provincial Bank at 3 per cent., the undertaking changed hands. The terms of settlement are that the Joint Authorities are to pay the bond debt of £4575 as provided by the Act, and compensate the officers and servants of the Company to the extent of £500. The amount to be paid for the undertaking is £54,925. The Local Authorities are to bear the expenses attending the winding up of the Company; and the latter are to discharge all their own liabilities with the cash retained in hand, the reserve fund, &c. The officers will be engaged for at least three months by the Joint Board.

The Local Government Board and the Typhoid Epidemic at Maidstone.—The Town Clerk of Maidstone has received an intimation from the Local Government Board that they have decided to direct a public inquiry to be held with reference to the outbreak and spread of the epidemic of typhoid fever in the town during the later months of last year. The date will be fixed as soon as the other engagements of their Inspectors will permit.

Stratton and Bude Water Supply.—The interminable delay in dealing with the question of the water supply of Stratton and Bude has at length moved some of the ratepayers to action. A representation was recently made to the Local Government Board that the Stratton District Council were in default in the matter. On Wednesday last, Mr. F. H. Tulloch, one of the Board's inspectors, held an inquiry into the cause of the complaint. On behalf of the memorialists, Mr. E. Shearme gave a detailed account of the negotiations respecting the water supply from the time when the matter was first mooted in 1874. In 1887, Mr. Anson reported on what was known as the Halls scheme; but a difficulty arose through the Bude Harbour and Canal Company claiming the stream as a feeder of the canal. Then the Canal Company invited the Rural Sanitary Authority to consider what was known as the reservoir scheme. This occupied them from 1887 to 1891; but in the latter year an agreement between the Company and the Authority was scheduled in an Act of Parliament. This agreement was not carried out. Consequent on the failure of the agreement, the Authority turned their attention to a scheme for obtaining a supply of water from Wrasford Moor, which it had under consideration from 1891 until in 1895 its duties were taken over by the Rural District Council. In 1895 and 1896, there were considerable droughts; and people questioned the adequacy of the Wrasford Moor supply without a reservoir, which Mr. Anson regarded as unnecessary. In 1896 Mr. Baldwin Latham was consulted as to the different schemes; and he reported in favour of the canal reservoir. The Canal Company were not prepared to bring in water in accordance with the agreement, but offered to sell the reservoir, &c. Then the Council went back to the Wrasford Moor scheme. But difficulties arose respecting the arrangements with the landlord and the tenants; and the Halls scheme was again taken up. A sum of £273 had been already paid in preliminary expenses, and £622 was still owing; and as there was no knowing where the expenses were going to stop, the memorialists thought it time to take action. Mr. J. King, the Chairman of the District Council, said the present supply was certainly inadequate and dangerous to health—an opinion which was endorsed by Dr. J. M. Braund (the Medical Officer of Health), the Sanitary Inspector, and several ratepayers. Mr. King said he should not consider £10,000 an excessive amount to pay for an adequate supply of water. The estimated cost of the Wrasford Moor scheme was £7370, with £1500 more for an impounding reservoir. In the result Mr. Mucklow, on behalf of the Canal Company, said he could not see any objection to the District Council coming to an arrangement with the Company. They would sell their interests at £2 per share, or £3600. Mr. King said the reservoir scheme was undoubtedly the best, and he would accept Mr. Mucklow's terms then and there, and offer the water to the District Council.



BATH HEATING BY GAS.

THE "ACME" WATER HEATER

With double fittings on Floor Stand.

IN POLISHED COPPER OR NICKEL PLATED.

By this arrangement **Hot Water** may be drawn for **Bathroom-Lavatory**, as well as for **Bath and Shower**; and thus a complete and elegant installation is secured at a very moderate cost.

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Price List and Terms on application.

EWART & SON,

346, 348, 350, EUSTON ROAD,

LONDON, N.W.

Telephone: 751 King's Cross. **Telegrams:** "GEYSER, LONDON."

Guernsey Water Company.—According to a statement which has appeared in a financial contemporary, the above-named Company are not in a very flourishing condition. The abundant rainfall of the past year led to a greatly restricted use of water by the "glasshouse consumers;" and with the view of inducing the fruit and flower growers to be a little more lavish, the charge for water required for their special purposes is to be lowered. Notwithstanding economical management, there was last year a loss of £1173, which unfortunately came upon one of three times the amount in the preceding twelve months.

Fatal Explosion of Acetylene Gas.—The following telegram from Jersey City, dated the 24th ult., reached England through Dalziel's Agency: "The experiments which were being carried out at the works of the Acetylene Company in the making of gas caused an explosion of an immense tank. The effect was appalling. There were 100 employees in the place at the time, a dozen of whom were bodily hurled 20 feet away, while 15 were killed outright. The explosion of the big tank caused others to follow, and in ten minutes there were as many separate explosions. The works were severely shaken and set on fire; and shortly after the flames broke out part of the building collapsed. All the firemen in the city were called to the scene of the disaster, as well as the hospital and police ambulances. The noise of the explosions was heard throughout the city, and caused great excitement; this being heightened by the sudden extinguishing of the electric light in all parts, as the electric works were only a block away from the gas-works."

Proposed Extension of the Wokingham Gas-Works.—Colonel J. T. Marsh, R.E., held an inquiry at Wokingham on the 22nd ult., with respect to an application made to the Local Government Board by the Wokingham Corporation for sanction to borrow £1500 for extending the gas-works. The Town Clerk (Mr. J. May) said the Corporation intended to provide a large gasholder, with a concrete tank, and a new photometer and governor. The expenses in connection with these works, added to the amounts already laid out, would make a total of £1626; but the Corporation hoped the sum applied for would suffice for their wants. Mr. Bates, the Manager, said that since the Corporation had had the works the quantity of gas manufactured had increased by 38 per cent.; and in the past year the consumption had augmented to the extent of 880,000 cubic feet. The Inspector remarked that the new works appeared to be very much required; and the Mayor (Alderman Heron) said they would materially lessen the cost of the production of gas. At the close of the inquiry, Colonel Marsh visited the works.

The Gelt Water Scheme of the Carlisle Corporation.—A representative meeting of the owners and ratepayers of Carlisle has been held for the purpose of considering the promotion of a Bill in Parliament to empower the Corporation to construct water-works at Geltsdale, Castlecarrock, and Cumwhinton. The Mayor moved the resolution consenting to the promotion of the Bill, and expressed his thorough appreciation of the scheme. The motion having been seconded, Mr. Westray submitted that the public had not been supplied with sufficient information upon which to form a judgment. Referring to Mr. Eaton's calculations as to the comparative cost of the rival schemes, he contended that the £3000 a year profit made by the present water-works should have been capitalized at £73,000 and added to the £120,000. This would have brought the total cost to something like £200,000. He contended that the city was not financially in a position to carry out such a scheme at a time when they were about to borrow £28,000 to extend the gas-works, £25,000 or £26,000 to provide electric light, and large sums for other purposes. Mr. B. Scott, a member of the Town Council, said there was no proposal to expend £28,000 on the extension of the gas-works. Such a suggestion had been made, but he thought they would be able to go on for some years as they were. There were several other speakers, both for and against the scheme, but the resolution was passed by a substantial majority.

By an announcement which appears elsewhere, our readers will see that the sale to be conducted by Mr. Alfred Richards on the 25th inst. will include a new issue of ordinary stock of the Tottenham and Edmonton Gas Company, similar stock of the Guildford Gas Company, debenture stock of the Ascot Gas and Southend Water Companies, and ordinary shares in the Lowestoft Water and Gas Company, as well as stock in the Taunton and Brighton and Hove Gas Companies. Except the last two parcels, all will be sold by order of the Directors.

Messrs. Fletcher, Russell, and Co., Limited, have issued a new price list of their workshop and trade appliances for gas, with duplicates suited for petroleum oil when gas is not available. The fact that 72 pages are occupied with descriptions of these appliances testifies to the large number of purposes to which the above-named fuels are applicable; and considering the ingenuity hitherto displayed by the firm in this particular direction, there is no reason why further developments should not take place. Where exact results are required, gas and petroleum assuredly are the fuels to use. Messrs. Fletcher, Russell, and Co. were the first to recognize this truth; and their new price list affords striking testimony to the success of their endeavours to give it practical application.

At the opening of each New Year we are usually favoured by various enterprising firms with copies of the diaries and calendars which they send to their clients. As a rule, these useful adjuncts to the office equipment are arranged to keep constantly before the user the fact that, while the days of each year come and go, the firms in question and the excellence of their productions are permanent. This being so, it is interesting to note that the calendar issued by Mr. Henry Simon, of Manchester, for the present year (its seventh edition) is a pleasing variation from the general rule. The blank space at the foot of each date is not occupied, as it might have been, by some laudatory notice of the Simon-Carvès ovens, or any other plant or appliances with which Mr. Simon may be connected, but by a motto or quotation, after the manner of Marcus Ward's "Various Authors" calendar. It may be objected that this is introducing sentiment into a strictly business domain. But we think it will be admitted that no man of affairs will suffer much by taking in, when he glances at the date, one of the noble thoughts which the compiler of the calendar, with the assistance of his friends, has presented to him.

R. & A. MAIN, Ltd.

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Telegrams: "GASMAIN, GLASGOW."

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BRISTOL:
28, BATH STREET.
Telegraphic Address: "GOTHIC."

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "GOTHIC."

MANCHESTER:
37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."

THE
"SALFORD"
Nursery Fire.

No. 581.

16½ in. wide by 6 in. deep by 19 in. high.

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No. 581.

THE
"SALFORD"
Nursery Fire.

No. 581.

Price - £1 7 6

Can be had fitted with Dutch Oven, 2/6 extra.

GWYNNE & BEALE'S

PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095, Holborn.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

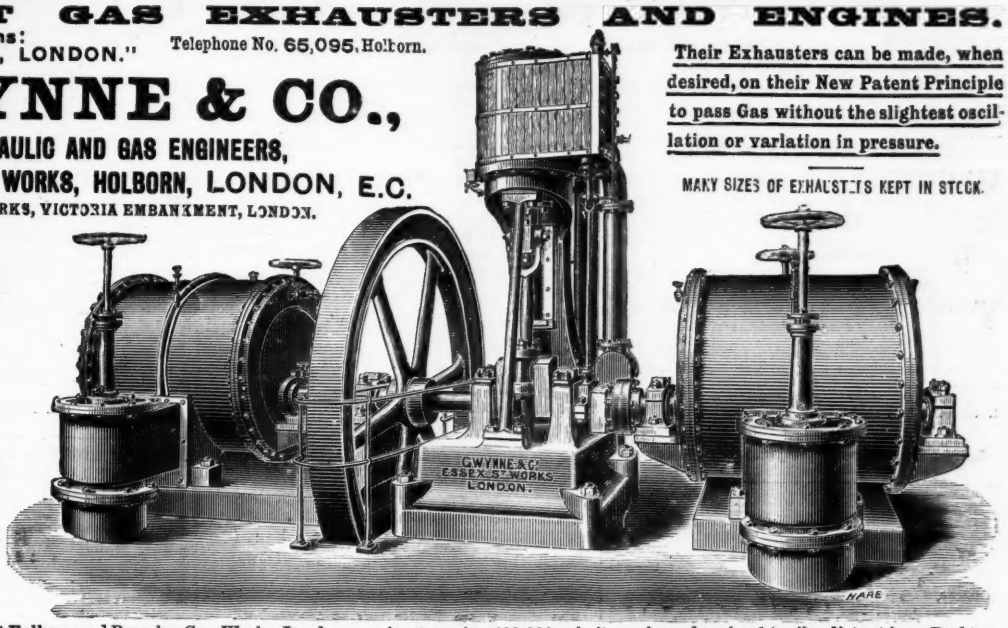
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 36,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see p. 49.]

SPENT OXIDE wanted.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
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GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
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OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.

IMPORTANT.

OLD Retorts made equal to new by repairing them with CROWTHER'S PATENT STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Can be used in Hot or Cold Retorts; and "A1." for Mouthpiece Joints. Satisfaction Guaranteed.
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WANTED, a Situation as Gas-Fitter, accustomed to Gas-Works Work in all Branches (out or in), Meter Testing, and Repairing.
Address No. 2980, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Stoker in small Works for Day and Night Shifts. Shovel Charging. Wages, 18s., with House, Garden, Gas, and Coal.
Apply, by letter, to No. 2979, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Improver for House Fitting, Fixing Cookers, Fires, Meters, &c. Improving position to an industrious person.
Apply, stating Particulars of Experience, Wages required, and References to FRED. J. WARD, Gas-Works, Knowle, near BIRMINGHAM.

WANTED, an experienced Man to take CHARGE of the INCANDESCENT GAS-LIGHTING DEPARTMENT of the Sheffield United Gaslight Company. He must be fully capable, and be responsible to the General Manager for the effective placing of these Lights in the most suitable positions.
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For Particulars, apply to the MANAGER, Gas-Works, Halesowen, near BIRMINGHAM.

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Apply, by letter, stating Wages and Age, with Experience, &c., to No. 2931, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, a Sole Manager to take charge of Small Works. One accustomed to Iron Retorts, and able to fix Meters, Service-Pipes, Mains, set Retorts, &c. House, Coal, and Gas found.
Apply to Mr. NEVILE DAY, Easton, near STAMFORD, stating Age, with References, &c.

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YOUNG'S Paraffin Light and Mineral Oil Company, Limited, require a MANAGER for their Mineral Oil Works at Addiewell. He must have had a thorough Engineering and Mechanical Training. One who, in addition thereto, has experience in a similar or kindred Industry would be preferred.
Applications, enclosing Certificates (which will be treated in strict confidence), to be addressed to
JOHN FYFE,
Managing-Director.
7, West George Street, Glasgow,
Dec. 22, 1897.

CITY OF LEEDS.

THE Gas Committee require the services of a SUPERINTENDENT of the MAINS and SERVICES DEPARTMENT. Applicants must possess a thoroughly practical knowledge of Main and Service Laying and the Distribution of Gas.
Salary, £250 per annum.
Applications, stating Age and Experience, with not more than three recent Testimonials, and addressed to the undersigned, endorsed "Superintendent of Mains," will be received not later than Monday, Jan. 17.
Canvassing members of the Corporation will disqualify Candidates.
JNO. HARRISON,
Town Clerk.
Dec. 24, 1897.

TO GAS PLANT MANUFACTURERS & OTHERS.

GENTLEMAN, with established con- nection among English and Foreign Gas Companies, and taking larger Offices than he requires in East India Avenue, Leadenhall Street, could arrange to ACCOMMODATE A MANUFACTURER when in London, or RECEIVE and FORWARD LETTERS, &c. Reasonable terms. Highest References.
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GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BAILINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

WANTED Carbon. State Price for 4-ton Lots, delivered at nearest Station.
Address No. 2960, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHURIC Acid for Sale B.O.V. and R.O.V. made from Sulphur. Inquiries solicited.
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FOR SALE—300 14-in. Street-Lanterns, with Cradles, in good condition. Reasonable offers will be considered.
Apply to the ENGINEER and MANAGER, Brentford Gas Company, High Street, BRENTFORD.

GAS-PUMP for Sale, horizontal, one Steam Cylinder, 18-inch bore, and two Gas Cylinders, 17½-inch bore, all 24-inch Stroke, on massive Bed-Plate, with heavy Fly-Wheels. Very strong. First-Class Make. Not much used.
Apply, by letter, to No. 2878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Modern Sulphate of AMMONIA STILL, built by Messrs. R. & J. Dempster, Manchester, 1893, with separate Liming Compartment. Capacity, with ordinary Liquor, 5000 to 6000 lbs. of Sulphate per day.
For further Particulars, apply to the BRYMBO STEEL COMPANY, LIMITED, near WREXHAM.

ABSOLUTELY SAFE INVESTMENTS.

FOR SALE—A Parcel of Shares in the PORTSEA ISLAND GAS COMPANY, paying Dividends of 12 per cent. and 13 per cent. respectively. The Company are on the Sliding Scale. Price of Gas 2s. 4d. per 1000 cubic feet. The Company have a Reserve Fund equal to one-quarter of the Capital.
Also £50 ORIGINAL 10 PER CENT. MAXIMUM DIVIDEND SHARES in the SOUTHAMPTON GAS COMPANY; and 7 PER CENT. MAXIMUM DIVIDEND SHARES.
£500 of WORTHING 10 PER CENT. MAXIMUM DIVIDEND STOCK.
Eight £12 10s. (fully-paid) 10 PER CENT. ORIGINAL SHARES in the SALISBURY GAS COMPANY.
£150 10 PER CENT. ORIGINAL CAPITAL STOCK in the LEWES (SUSSEX) GAS COMPANY.
Fifty £10 (fully-paid) ORIGINAL SHARES in the PORTSMOUTH WATER-WORKS COMPANY, paying the full Statutory Dividend of 10 per cent.
£500 10 PER CENT. STOCK in the GOSPORT WATER-WORKS COMPANY, paying a Dividend of 10 per cent.
Further Particulars on application to LOVE AND COOPER, Stock and Share Brokers, PORTSMOUTH.

ROTHERHAM CORPORATION.
(GAS DEPARTMENT.)

FOR SALE—The following Second-hand GAS PLANT, in good condition:—
Two 83,000 Cubic Feet per hour ROTARY EXHAUSTERS, complete with 12-inch Connections and Bye-Pass.
One 10-Horse Power VERTICAL STEAM-ENGINE.
One 10-inch STATION GOVERNOR.
One 12-inch STATION GOVERNOR.
Three 18-inch RACK AND PINION VALVES.
Seven 12-inch RACK AND PINION VALVES.
Full Particulars and Price from
FRANK A. WINSTANLEY,
Engineer.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of FIRE-CLAY GOODS.
Specification, Quantities, and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Tenders, endorsed "Fire-Clay Goods," to be sent to me not later than Tuesday, the 18th of January, 1898.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings, Heywood,
Dec. 31, 1897.

TO GASHOLDER MAKERS.

THE Directors of the Castlebar (Co. Mayo) Gas Company, Limited, invite TENDERS for the erection of a new GASHOLDER at their Works. Diameter of Holder, 30 feet; and the depth at sides, 12 feet.
The Firm whose Tender may be accepted will be required to cut out the old Holder.
Specification and Drawings requested from the Firms sending Tenders.
The Directors do not bind themselves to accept the lowest or any Tender.
Tenders to be lodged with the Secretary on or before the 25th inst.
Dated this 1st day of January, 1898,
J. SHERIDAN,
Secretary.

CORPORATION OF LEICESTER.

CAST-IRON PIPES.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply and delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 24 inches in diameter, required during the Twelve Months ending the 31st of December, 1898.
Specification and Form of Tender to be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Cast-Iron Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock on Saturday, Jan. 8, 1898.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, Dec. 31, 1897.

NEW MILLS URBAN DISTRICT COUNCIL.

THE above Council invite Tenders for the supply and delivery of—
6-inch WATER-METERS (Siemens' preferred), with Flange Connections.
4-inch WATER-METERS (Siemens' preferred), with Flange Connections.
3-inch WATER-METERS (Siemens' preferred), with Flange Connections.
Also the necessary SPECIAL CASTINGS that may be required for connecting same.
Offers for Second-hand Meters will be accepted; but a guarantee of correctness and good working will be required.
Tenders, either for new or second-hand, to state price for each size of Meter, and per ton for Specials (the whole to be delivered at New Mills), and to be sent to me the undersigned not later than Twelve o'clock noon, Jan. 12, 1898.
The lowest or any tender not necessarily accepted.
JOSEPH POLLITT,
Clerk to the Council.
Town Hall, New Mills, Dec. 31, 1897.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of: (1) WET GAS-METERS. (2) DRY GAS-METERS. (3) FIRE-CLAY GOODS. (4) IRONMONGERY. (5) STEEL GOODS. (6) WROUGHT-IRON GOODS. (7) IRON VALVES and CONNECTIONS. (8) TARRED GASKIN and TWINE. (9) STOKERS' GLOVES. (10) OATS, BRAN, HAY, STRAW, &c., required during the ensuing Twelve Months.
Forms of Tender and further Particulars may be obtained on application to Mr. Thomas Holgate, C.E., Gas Engineer, Halifax.
Tenders, properly endorsed, to be sent to the undersigned before Ten o'clock a.m., on Wednesday, the 12th of January, 1898.
The person whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
KEIGHLEY WALTON,
Town Clerk.

FOR DISPOSAL, BY TENDER.

THE Professional Library of the late Mr. F. T. C. Linton, of Leith, consisting of about 160 Volumes, all in condition equal to new.
The Books comprise Volumes of the "Journal," "Engineer," "Engineering," Transactions of various Societies, and Miscellaneous Works on Gas and other Engineering Subjects. A full list can be inspected at the Office of the "JOURNAL."
Tenders for the Books will be received up to Jan. 15, addressed to No. 2977, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TENDERS FOR GAS COAL.

THE Magistracy of Copenhagen are pre- pared to receive TENDERS for the supply and delivery of 110,000 Tons of best GAS COAL during the Year 1898, from April to the end of December.
The Magistracy reserve to themselves the right to divide the Contracts between two or more Contractors.
Further Information and Conditions for the delivery may be obtained on application to the Lighting Department of Copenhagen, Vestre Boulevard, Copenhagen V.
The Tenders (sealed) to be sent to the Magistracy of Copenhagen, Fourth Division, before Jan. 14, 1898, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who are in attendance.
THE MAGISTRACY OF COPENHAGEN.
Dec. 20, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

By order of the Directors.
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE OF £11,701 STOCK.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 25, at Two o'clock, in Lots,
£11,701 OF CAPITAL STOCK,
Ranking for a Standard Dividend of 7 per cent., subject to the Sliding Scale—the last Dividend on similar Stock having been at the rate of 9 per cent.
Particulars at the COMPANY'S OFFICES, in Willoughby Lane, TOTTENHAM; of Messrs. MERRIMAN, PIKE, and MERRIMAN, Solicitors, 25, AUSTIN FRIARS, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.
LOWESTOFT WATER AND GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday Jan. 25, at Two o'clock, in Lots,
1000 ADDITIONAL ORDINARY £10 SHARES,
Ranking for a Maximum Dividend of 7 per cent.
Particulars may be obtained of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Tuesday, the 25th of January, 1898, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.
£4100 FOUR PER CENT. PERPETUAL DEBENTURE STOCK OF THE ASCOT DISTRICT GAS COMPANY.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 25, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.
GUILDFORD GASLIGHT AND COKE COMPANY.

SALE OF £5000 STOCK.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Tuesday, Jan. 25, at Two o'clock, in Lots, £5000 of ORDINARY STOCK in the Guildford Gaslight and Coke Company, ranking for a Standard Dividend of 5 per cent. per annum—the last Dividend on similar Stock in the Company having been at this rate, free of Income-Tax.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TAUNTON GASLIGHT AND COKE COMPANY.
BRIGHTON AND HOVE GENERAL GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, the 25th of January, at Two o'clock,
£970 of ORDINARY STOCK in the Taunton Gaslight and Coke Company; and
£300 ORIGINAL STOCK in the Brighton and Hove General Gas Company.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CITY OF MANCHESTER.

TENDERS FOR CAST-IRON PIPES.

THE Gas Committee are prepared to receive, on or before Thursday, the 13th of January, 1898, TENDERS for the supply of about 530 Tons of CAST-IRON PIPES of 3 inches and 4 inches diameter.

Specifications and Forms of Tender may be obtained on application to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Dec. 31, 1897.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the Directors of the above Company intend to OFFER FOR SALE, by Public Auction at the Mart, Tokenhouse Yard, in the City of London, on Tuesday, the 25th of January, 1898, at Two o'clock in the afternoon precisely, £11,701, being Balance of amount of "C" STOCK issued under the Powers of the Tottenham and Edmonton Gas Act, 1882.

By order,
JAMES RANDALL,
Secretary.

Offices of the Company
Willoughby Lane, Tottenham,
Dated this 24th day of December, 1897.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that Rudolf LANGHANS, of 12B, Elisabeth Strasse, Berlin, in the German Empire, has applied for LEAVE TO AMEND THE SPECIFICATION of the Letters Patent, No. 22,396 of 1893, for "Improvements in the Manufacture of Incandescent Bodies for Incandescent Gas Lighting."

Particulars of the proposed Amendments were set forth in "The Illustrated Official Journal (Patents)," issued on the 22nd of December, 1897.

Any person, or persons, may give Notice of Opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

(Signed) C. N. DALTON,
Comptroller-General.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that Rudolf LANGHANS, of 12B, Elisabeth Strasse, Berlin, in the German Empire, has applied for LEAVE TO AMEND THE SPECIFICATION of the Letters Patent, No. 23,137 of 1895, for "Improvements in the Manufacture or Production Electrolytically of Coatings composed of Oxides of the Earth Metals."

Particulars of the proposed Amendments were set forth in "The Illustrated Official Journal (Patents)," issued on the 22nd of December, 1897.

Any person, or persons, may give Notice of Opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

(Signed) C. N. DALTON,
Comptroller-General.

ALEXANDER CAMERON,
GAS AND CANNEL COAL MERCHANT,
48, WEST REGENT STREET,
GLASGOW.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
3 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

THE
"ETNA" FIRE & HEAT RESISTING
CEMENT,
For RETORT PURPOSES, is INVALUABLE.
Sole Manufacturers:
FRED VERITY & SON,
CALL LANE, LEEDS.
Scores of Testimonials received. Write for Particulars.

BATTERSEA POLYTECHNIC, London, S.W.

DAY COURSES IN APPLIED CHEMISTRY FOR TECHNICAL STUDENTS.

Head of Chemical Department—W. A. BONE, D.Sc., Ph.D.

Special Day Courses of Instruction in EXPERIMENTAL CHEMISTRY AS APPLIED TO GAS LIGHTING will be given during the ensuing Term, commencing Jan. 10, 1898. The object of these Courses is to impart a thoroughly scientific training in the special branch of Applied Chemistry; and they are specially suited for Youths who are preparing themselves for positions of responsibility in this particular Industry. The Laboratory is open daily. Special Evening Courses for Artisan Students.

A NEW TECHNICAL DAY SCHOOL for Boys preparing for the Building, Mechanical, or Electrical Engineering Trades will be opened Monday, Jan. 10. Fee: £1 per Term.

For Particulars and Prospectuses of other Schools and Classes apply to the SECRETARY.

GAS PURIFICATION BY
HYDRATED OXIDE.
THIS Material is of full Strength, and Exceptional Activity. It is specially prepared to minimize Back-Pressure; and will be supplied on Hire, or Sold, on the most favourable Terms.
SPENT OXIDES containing Blue, also CRUDE FERRO-CYANIDE PRODUCTS, either PURCHASED or EXCHANGED for FRESH OXIDE.
MANCHESTER OXIDE COMPANY, LTD.,
CANAL ST., MILES PLATTING, MANCHESTER.

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CANNEL COAL MERCHANT,
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Prices and Analysis of all the Scotch Cannels on Application.

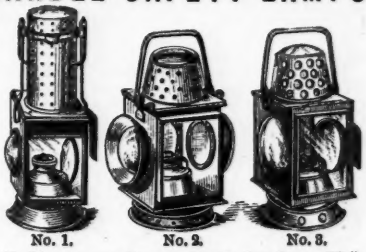
Telephone: Castleford No. 214. | Postal Address: Castleford.
Telegrams: "Silkstone Castleford."
THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.
ALLERTON BYWATER, CASTLEFORD.
Steam, Manufacturing, & Gas Coals & Cannel.
Analysis, Contracts, Trial Waggons, and Quotations for Large and Small Orders. Inquiries Solicited.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY, LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

GAS—NO MORE MANTLES.
BILLING'S NON-MANTLE INCANDESCENT GAS-BURNER. Perfect Light and Cheapness combined. 5s. 6d. Complete; Postage, 6d. extra. Lasts a Lifetime. Can be fixed to any existing Gas-Fittings. Gas-Fitters invited to see it; and Agents required.
Offices, where Samples can be seen (ROOM K),
17, GREAT TITCHFIELD STREET, W.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.
43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

BOLDON GAS COALS.
ANALYSIS.

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON NEWCASTLE."

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
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TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16$\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13$\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England, and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

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(Late JAMES WHITE & CO.)

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MANUFACTURERS OF

HIGH-CLASS FIRE-BRICKS, acknowledged to be the best obtainable for

GAS, IRON, AND CHEMICAL FURNACES.

For Analysis and Prices, address—

JAMES WHITE & CO.,

WIDNES, LANCASHIRE.

INCANDESCENT GAS LIGHTING

Has now gained a complete and final **Victory** over its last and greatest Enemy

VIBRATION,

BY MEANS OF

CLAY'S PATENT

SHOCK-PROOF

Incandescent Burner Fittings

Of which full Particulars may be had from

CLAY & WALMSLEY,

BOLTON, ENGLAND.

Telegrams: "CLAYS, BOLTON."

See "JOURNAL OF GAS LIGHTING," July 7, 1896, p. 19, and Dec. 21, 1897, p. 1965.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

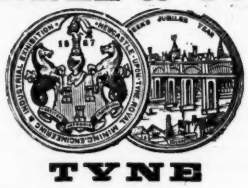
For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

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21 JOHN STREET, ADELPHI, LONDON, W.C.

INCANDESCENT GAS-LIGHT

(Patents in England No. 2000, 1895; No. 15,500, 1896)

NO INFRINGEMENT OF THE "WELSBACH" PATENT.

HIGHEST LIGHTING POWER, IN COMBINATION WITH GREATEST DURABILITY.

Mantles Impregnated, 100 pieces 26s.

Extremely Solid Mantles, ready for Conveyance, **100 pieces 40s.**

ALL MANTLES SUPPLIED WITH HEAD FIXED.

HUGO CAHEN, Manufacturer of Incandescent Gas-Fittings,

BERLIN C., SCHARRENSTRASSE, 15.

JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

Telegrams: "EVANS WOLVERHAMPTON." PLEASE APPLY FOR CATALOGUE No. 8. National Telephone No. 7039.

12,000 PUMPS IN STOCK AND PROGRESS.

TRADE MARK.

NO TAPPETS.

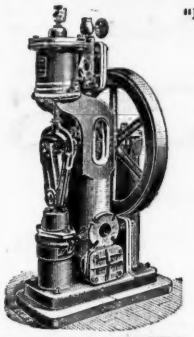


Fig. 705. "SINGLE RAM" STEAM-PUMP.

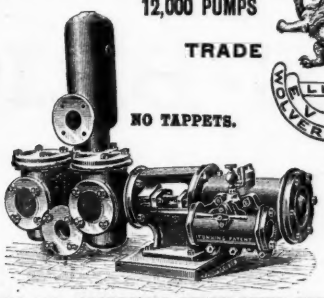


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

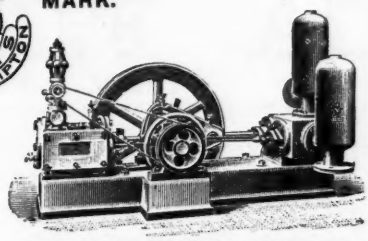


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

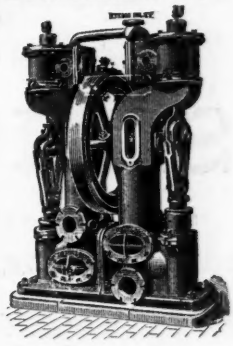
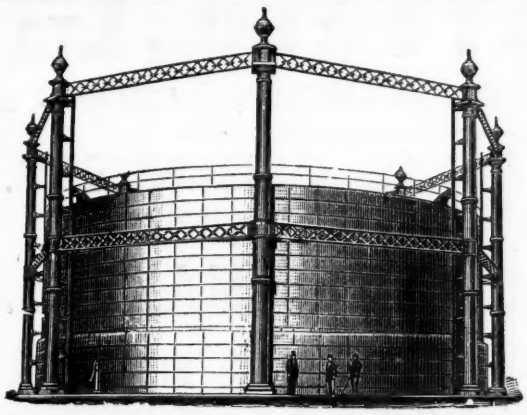


Fig. 712 "DOUBLE-RAM" STEAM-PUMP.



PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS, IRONFOUNDERS, & CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

Telegraphic Address: "PORTER LINCOLN." National Telephone, No. 13.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

References to 600 Works already erected.

N.B.—All Communications to be addressed to the FIRM ONLY.

W. J. JENKINS & CO.,

MOUTHPIECES

WITH SELF-SEALING LIDS FOR

HORIZONTAL AND INCLINED RETORTS.

RETFORD.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

THE SILICA FIRE-BRICK COMPANY,

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Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

MANUFACTURERS OF

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Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

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55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

PRICE LISTS ON APPLICATION.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF

GASHOLDERS & GAS PLANT,

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES, PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF

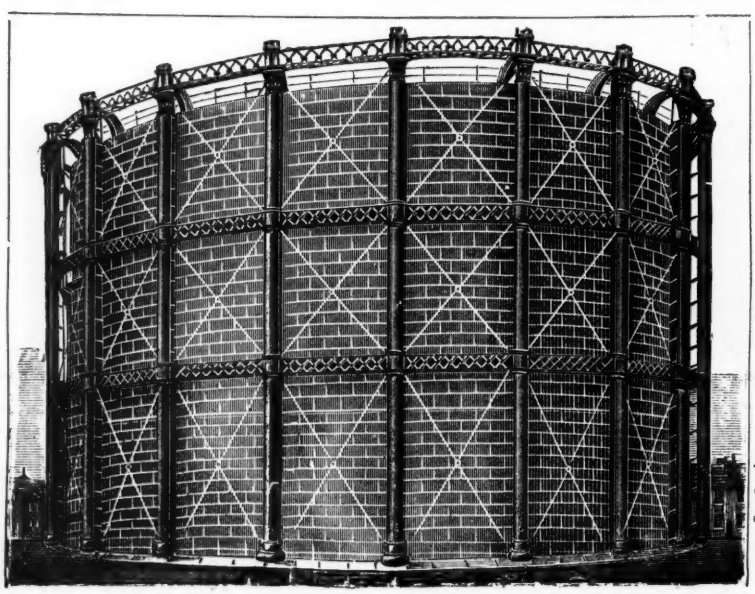
STRUCTURAL IRON

AND STEEL WORK.

BRIDGES,

ROOFS,

PIERS, ETC.



WORKS AND HEAD OFFICE

TIPTON,

STAFFORDSHIRE.

LONDON OFFICE:

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WESTMINSTER.

TELEGRAPHIC ADDRESSES:

"HORSELEY, TIPTON."

"GALILEO, LONDON."

COLUMNLESS HOLDERS.

Notwithstanding the antagonistic influence of firms who are not permitted to construct Holders on **GADD & MASON'S PATENT SPIRAL GUIDE SYSTEM,** their adoption grows larger every year. Intelligent Gas Engineers appreciate the **GREATER SAFETY** of these Holders, and the very great **SAVING IN COST** of from **20** to **30 PER CENT.** No first-class Engineer should now think of paying for so much Metal in the shape of Columns, and the Labour of Erection.

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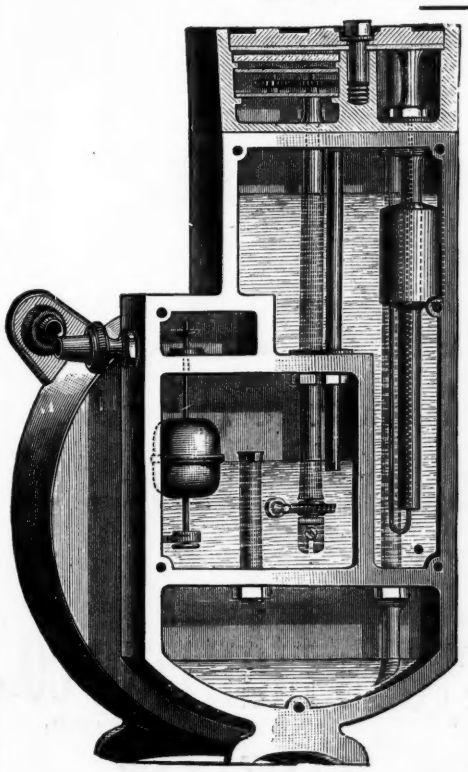

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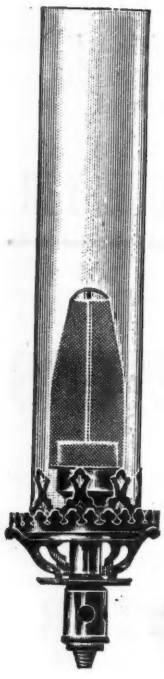

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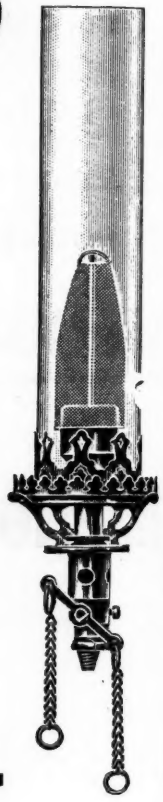

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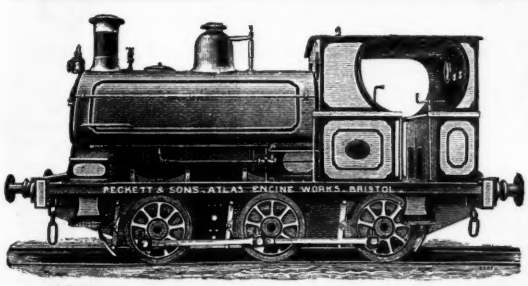

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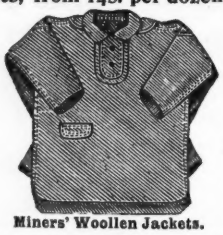

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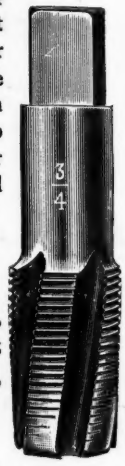

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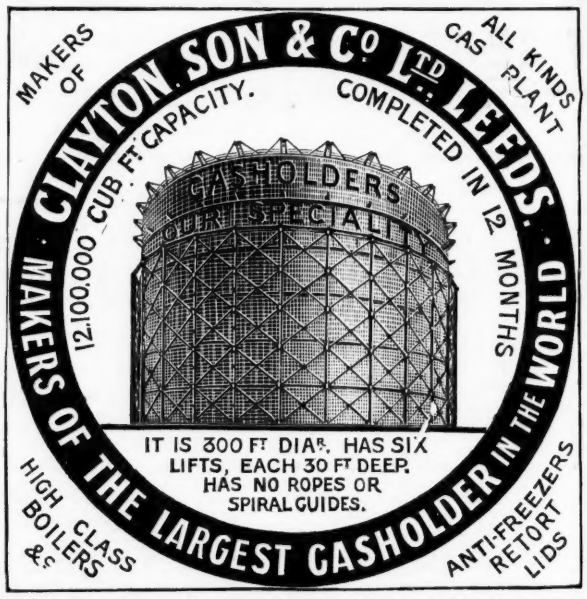
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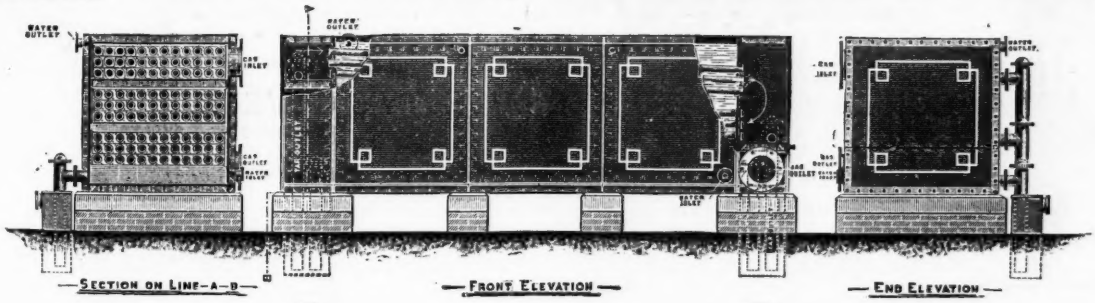

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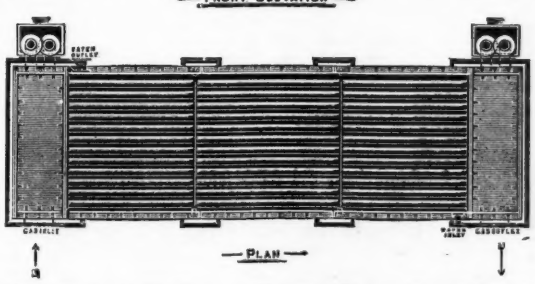

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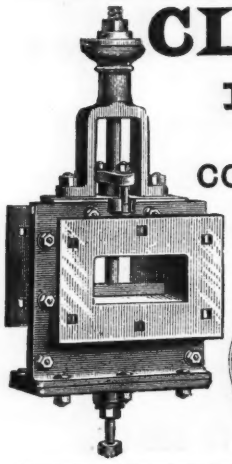

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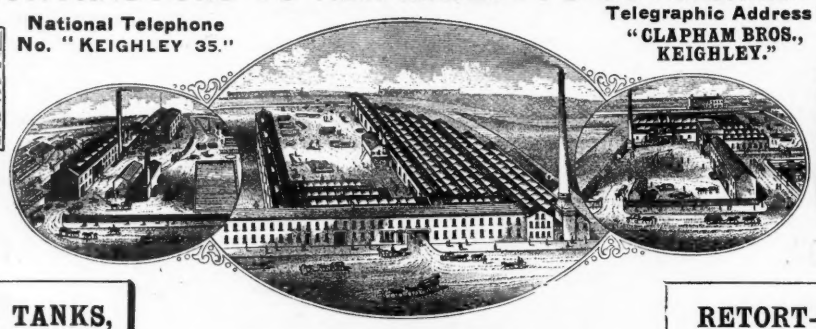

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